MONTANA OUTDOORS

The Wild Missouri

FIFTY CENTS

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THE COVER

Of the mighty Missouri's many miles, only 170 remain wild and free. Today, that unaltered stretch is the basis for a wide array of outdoor enjoyment, which is the topic of the cover story (page 19). Front cover photos are: sunrise — Steve Bayless, canoes — Bob Cooney, and whitetail deer — Alan Nelson.

Antelope fawn on the back cover by Ray Mapston.

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ASHTON'S

a livable environment for WILDLIFE is a quality environment for MAN

During a time when more people are demanding more and more from Montana's resources, this department's responsibilities to wildlife and recreation become increasingly important. To help meet increased demands on our resources and wildlife, the department's land acquisition program is a vital and necessary function.

Land for game ranges and fishing access is already scarce. But what will it be like in 10 years? Or, in 50? Recreational land available for purchase to the public increases in cost year by year. And what about potential public recreation and fishing access sites that are subdivided or otherwise developed? Such activities remove these lands from possible public enjoyment.

Acquisition of game range lands helps insure the future of Montana's big game populations. By acquiring a relatively small piece of first-class winter range, the game population over a large area is benefited.

Other acquisition programs include fishing access sites on lakes and streams, state parks, recreation areas, access corridors to federal and other public lands, historic sites and state monuments. Of course, these lands are all *open* to public use and enjoyment.

The two purposes of our acquisition programs—to provide and improve wildlife habitat and outdoor recreation opportunities—are in the best interests of all Montanans. Therefore, it's difficult to understand opposition to the program by sportsmen and other recreationists.

Department controlled lands amount to less than one-fourth of one per cent of the total land area of the state. Acquistion of most lands does not remove them from county tax rolls; counties continue to receive payments "in lieu of" (but in the same amount as) land-based property taxes.

This department's land acquisition program benefits all Montanans and Montana's wildlife. To provide future *public* recreational lands, we need *public* understanding and support for the program. Hopefully, we'll continue to purchase key tracts of land for wildlife and recreation within the restrictions of our budget.

Wes Woodgerd

Wes Woodgerd, Director
Department of Fish and Game

photo by author

THE GOATS ON DOME SHAPED MOUNTAIN

. . . have taught us something

IT WAS JULY 1971, the second summer of a three-year behavioral and ecological study of mountain goats in Montana's Sapphire Mountains. To gather more information, we were installing radio collars—the only way to keep track of goat movements.

Our operations center was Dome Shaped Mountain where a large slope, damaged by fire in 1917, served as a natural salt lick for goats, elk and mule deer. Success in collaring mountain goats, the culmination of much trial and error, was an experience we — Peter Smith, Gordon Maclean, my wife, Lynn, and I — had looked forward to for some time.

Summer in the mountain goat's high country is different from that which occurs in lower areas. In late May and early June the Sapphire Mountains, some of which extend to 9,000 feet, are still deep in snow. The goats then occupy south-facing cliffs at lower elevations because snow limits availability of food in higher areas. Solitary goats, especially adult males, are seen crossing the high ridges at this time.

June is a difficult month to obtain information about Sapphire goats, since batteries powering the radio collars usually wear out by spring and seldom can be replaced at this time. Goat activity is traced by observation and by following tracks on foot in the snow. We see mountain goat kids and their mothers in the high country for the first time in late June, although the kids are born earlier in the month. The salt lick on Dome Shaped Mountain draws adventurous goats in June, but it isn't used regularly until after the last big snow storm, typically in early July. From five to ten goats are then seen for hours at a time in groups on the lick's barren slopes.

In August goats use the higher areas extensively. The scattered snowbanks provide welcome relief from heat and numerous flies. The salts which goats crave in July are no longer needed in large quantities in August so use of the salt lick declines. North-facing slopes in-

BY CHESTER RIDEOUT

The successful management of any game animal depends on facts. Research projects like Rideout's produce those facts. (photo by Dave Johnson)

THE GOATS continued

crease in popularity with the goats, which will utilize an area for three or four days and then trek several miles to another cliff area. August nights are usually frost free, and daytime temperatures may reach from 75 to 80 degrees.

successful to the end?

Mountain goats are incredible creatures. Those catching glimpses of them high in mountainous country have marveled at their toughness: ability to make rapid climbs on sheer cliffs, extreme resistance to cold, and varied diet. Mountain goat horns — far more effective in battle than horns or antlers of any other big game animal in North America —are curving black spikes capable of inflicting deadly puncture wounds. The species has been fortunate and still exists in most of the ranges occupied when the first white men explored the mountain west. At that time, as now, they occurred in remote high country of Washington, Idaho, Montana, Alberta, British Columbia, the Yukon and Alaska.

Why are goats so successful? First, they live in country people haven't been able to use very much because of difficult access. Also, goats aren't fussy eaters, requiring only that winter feeding areas be relatively free of snow. Their hooves are soft. This, combined with flexible front-leg joints and a center of gravity about halfway between front and hind legs, means they can negotiate nearly all cliffs. Their coat provides a layer of insulation several inches thick in the winter and the white wool is as fine as cashmere.

Another key to success of the mountain goat is their social behavior. They don't form large herds during most of the year; groups of two to four are average. Adult males (billies) and older juveniles of both sexes are particularly independent and frequently are seen alone. Goats travel considerable distances in the Sapphires, occasionally as far as six miles or more daily. Other observers have seen billies traveling between herds during rutting season. Independence, wanderlust and toughness mark the character of the Rocky Mountain goat.

In 1924 and 1929, 10 mountain goats escaped from an enclosure in the Custer State Park Zoo in the Black Hills of South Dakota. These goats migrated north to the rugged Needles area where they formed the basis for the present population of about 300 animals. This is one example of the mountain goat's success when introduced into unoccupied terrain. Other transplanted herds are located in the Olympic National Park in Washington, a few ranges in Wyoming, the Collegiate and Gore Ranges and the San Juan Mountains in Colorado and in at least eight isolated ranges in Montana unoccupied by goats prior to Fish and Game transplants.

Classification of the mountain goat is often misunderstood in the popular literature. This species, *Oreamnos americanus,* is not closely related to any species in North America. It is a "goat antelope." Recent popular articles erroneously claim the mountain goat is a close relative of the pronghorned antelope; one article even awarded it the outdated species name *Oreamnos missoulae!*

Because they are seldom seen in their high-country habitat, mountain goats are probably the least known of North American game animals. Also contributing to lack of knowledge is the species' extremely poor survival record in captivity. Some mountain goats confined in the New York Zoological Park died prematurely and goats introduced into Custer State Park Zoo did not do well during confinement. Furthermore, few scientific studies have been carried out because of logistical problems.

behavior on the salt licks

My behavioral observation focused on interaction at salt licks. The mountain goats spend long periods in the lick area, returning several hours a day over a three- or four-day period. Tempers often flare during periods of licking salt, and goats threaten each other frequently. One animal will approach the other, display his horns and cause the other to back off rapidly. While the aggressor licks the more desirable spot, the subordinate animal must settle for other nearby areas. The pecking order at salt licks is quite distinct: with few exceptions, adult males are dominant over females and older animals over younger. This is contrary to the claim by other observers that females are usually dominant over males.

Occasionally goats line up side by side in salt lick encounters, head to flank, and march around one another in a stiff-legged display. The activity is often accompanied by head tossing, which probably symbolizes a blow with the horns. When carried out by kids, which are as yet hornless, it includes repeated butting under the belly. Close looks at older males indicate they too deliver blows to the abdomen and flanks with the horns, because scars are common on the rumps and bellies of adults.

When salt lick interactions were first observed from close range, I was surprised at the goat's voices: wavering humming sounds, snorts, grunts and sheep-like bleats filled the air. Goats have been thought to be mute, and much of the literature claims they produce no sounds. However, this occurs because few people

ABOUT THE AUTHOR

Chester B. Rideout, 29, is a teaching assistant working toward his Ph.D in systematics and ecology at the University of Kansas, Lawrence. He received a B.S. degree from the Universty of Wisconsin in Madison in 1965 and an M.S.T. in biology from the University of Montana, Missoula, in 1972.

have been close enough to them during aggressive activities to hear these vocalizations.

The Sapphire goats are extremely wary of people, which is quite different from goats observed in Glacier National Park. Goats in Glacier, since they frequently see hikers and are not hunted, have little fear of man. People seldom venture into goat ranges in the Sapphires, and when they do it is to hunt. As a result, the Sapphire goats are cautious and difficult to approach. Radio tracking has helped us follow daily activities of goats in the Sapphires, an impossibility by observation alone.

Despite difficulties of such a study, the mountain goat lends itself well to a radio tracking study for several reasons. Radio equipment frequently performs better in the mountains because signals are often transmitted line of sight to mountain-top antennas and thus have a greater range. In mountainous habitat there is also less radio interference; there are no engines, high power lines or wire fences to block signals. Also, goats stay relatively dry, causing less danger of transmitter failure. Finally, goats are more frequently seen than many other big game animals because they are active during the day and often are on open cliffs.

One of the most interesting aspects of radio tracking is that the signal of the directional loop antenna around the animal's neck varies in intensity if the animal is moving. This allows the listener to determine daily activity, because a steady signal means the animal is resting. If regular monthly recordings are made, they can be compared. We use two large citizen's band antennas to monitor the goats in summer, locating them by airplane during fall, winter and spring.

By radio telemetry and visual observation we have found that a typical day for goats in the Dome Shaped Mountain area consists primarily of feeding for short periods, followed by bedding and chewing of their cuds. (Like cattle and deer, they are ruminants, with a four-chambered stomach.) Goats rise with the sun, and morning is a period of considerable activity. Early afternoon is primarily a time for rest. Dust bathing is common when flies are bothersome: the reclining goat reaches forward with one leg to throw back a cloud of dust. The remainder of the day alternates between activity and rest; goats are quite active in early evening hours and several instances were recorded when activity of the males continued through even the darkest nights.

Collared animals were frequently observed from close range. Radio tracking provides a sixth sense which initially is just as strange as any additional sense would be. It isn't until the equipment has been used for some time that it serves as a second pair of eyes. The radio equipment also makes it possible to identify all of the areas which are popular with the animals.

threat to the goat

Since most of their domain is above civilization's advances, mountain goats have so far been successful as a species. However, new penetration by roads and higher concentrations of people threaten their existence. In the area studied, clearcut logging some 700 acres at altitudes of greater than 7,500 feet recently has been completed. This logging infringes on goat habitat. Effects on goats of logging, increased road use and penetration by the public need to be documented. Mountain goats become accustomed to hikers, but their populations have sometimes been decimated when their habitat has been penetrated by roads, particularly those constructed below favorite cliffs. Hopefully this study and others like it can help to determine requirements of this wilderness species before too much environmental alteration occurs. Then, guidelines for the wise use of these public lands can be drawn.

At the end of the summer we again had to leave the goats and their mountain habitat. Gordon, who lives in the Bitterroot Valley below, planned to take more fall hikes and to track the goats from an airplane during the winter. On a bright morning following a rain, we packed up and headed down the trail. We were traveling light, since a helicopter had lifted out our gear, and we stopped occasionally to locate the goats. The snow which had been so plentiful in late May was gone except for a few patches. Dwarf huckleberry and mountain heath glistened with the newly fallen rain. In the east, Georgetown Lake reflected the morning sun, and the Anaconda Pintlars stood tall in snow-capped majesty. We would miss the Sapphires—their isolation and peace—until the next year when again we would live with the mountain goats of Dome Shaped Mountain.

Even the youngest mountain goat can negotiate high rocky places. See next page. (F&G photo by Eldon Smith)

Next Time

Watch for these features in the July/August 1973 issue of MONTANA OUTDOORS

—Montana coal (part four)
—teaching women to hunt
—Montana owls
—huckleberry cookery
—recycling in Montana
—legislative roundup
—agricultural siltation
—logging and water

FROM 'TRASH TO KILOWATTS'

From the CITIZENS' BULLETIN of the Environmental Protection Agency (EPA) comes word of a project in St. Louis by which garbage is helping to supply electric power — useful energy from solid waste.

"Trash to Kilowatts," as the project is named, is sponsored by Union Electric Co., the city of St. Louis and EPA.

Daily, about two million pounds of refuse are hauled to the city's old incinerator where it is shredded and ferrous metals removed by magnets. This shredded waste is hauled to a Union Electric plant, 18 miles away, where it is fed into boilers at a ratio of 10-15 per cent garbage to 85-90 per cent soft coal. This generates steam for a 140-megawatt turbine.

St. Louis now is using 10 per cent of its garbage to produce electric power; the goal is utilization of 30 per cent of the city's daily refuse.

Project engineers have found it difficult to remove metals that aren't magnetic. However, they are optimistic that the system will prove to be technically and economically feasible and that other communities might follow St. Louis' example of using waste to produce valuable energy.

"Conservation might be defined as the American journey backwards, from West to East —dedicated citizens moving to preserve what's left of the West, to restore the middle and eventually, I guess, to just plain reinvent the East." — *Vance Bourjaily, "Contentment on your own Land," NATIONAL WILDLIFE*

PADDLEFISH CAVIAR

Al Elser tells me the paddlefish not only furnishes some pretty fine steaks, but that its eggs are valued as caviar. (See his paddlefish article on page 30.)

Elser, regional fish manager in Miles City, provides the following "recipe" for the delicacy:

1. By using a colander or screen, separate the paddlefish eggs from the membranes, keeping the eggs on ice.

2. Prepare a brine solution (1-1/8 cups of *pickling* salt to one quart of cold water) and soak eggs for half a day. The solution must be kept cold while the eggs are soaking.

3. Drain over a colander, put the eggs in small jars and refrigerate immediately.

Enjoy a bit of the caviar spread on your favorite kind of cracker and remember that the same thing from a specialty shop or the gourmet section of your supermarket would cost $10.50 for four ounces!

HUMANE TREATMENT FOR ANIMALS?

Nathaniel P. Reed, U. S. Department of the Interior, Assistant Secretary for Fish, Wildlife and Parks, had this to say in an address to the American Humane Association:

"In considering what is humane in treatment of animals, is it worse to cleanly kill a selected duck with a gun or to cover it with oil, drain its marshes so it can't reproduce or eat, or subtly poison it with pesticides or other chemicals over a period of years?

"The issue of anti-hunting is a false one because it sidetracks people from attacking the real threats to our native wildlife. It's not the hunters, but the heads of the water development agencies, the mineral extractors, the energy producers, the timber cutters, the stream straighteners, the stockmen's associations and the real estate developers who are destroying America's wildlife.

"What these people do will have far more effect on the future of wildlife than I, or any of my successors, or all the hunter groups put together."

ARE YOU GAME?

A section featuring game recipes is planned for a later issue. I'm sure many of you have favorites which you would like to share with other readers. Please send them to me, in care of the magazine, Department of Fish & Game; Helena, MT 59601.

FROM A JAR . . . . . TO YOUR WALL

You've probably heard of using crushed glass as a road surface (glasphalt). A researcher at Colorado School of Mines at Golden is using crushed glass and building debris to make wall panels and other building materials.

Clifford Shutt crushes the glass and debris, places it in a form and fires it in a kiln. The result resembles rough marble; various dyes can be added to match any decor. The "marble" is stronger and less costly than wood.

It's a good idea: utilizing waste rather than wood from an oversubscribed timber resource.

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how montana students rate

The last issue of the now defunct LIFE magazine contained the results of a reader questionnaire the publication distributed last fall. The four-page article was the generalized response of some 250,000 students, aged from 6 to 12, from across the nation.

Following true to form, the youngsters came through with some thoughts that no adult could ever conceive. A few are:

—"Sir, If I had a wish for the world, I'd say to stop pollution. Old beer cans smell."

—"I think there should be a Children's Lib."

—"Just because we're short doesn't mean that we can't say something worth listening to."

—"My family has what they call a family meeting. Everytime I make a suggestion, I am told to be quiet."

—"I want to know that if sex is supposed to be so beautiful, why don't they talk about it?"

—"P.S. I am writing a book called, *Search for Serenity*. Would you be interested?"

Of special interest to Montanans, however, was the fact that the children (63 per cent of those responding) thought the killing of wildlife, (hunting, in many cases) was the environmental problem that bothered them most.

One youngster from Indiana wrote, "Every day on the front page a man or even a woman proudly holds up a deer he shot—a beautiful, wild and harmless creature. It makes me almost literally sick." And another from Oklahoma said, "I am never going to kill anyone or anything," and suggested that "since animals are unhappy in zoos, the best thing for them is a big fenced area where they may not be killed."

We've covered this topic many times in MO, always stressing that habitat destruction poses the most serious threat to wildlife, not hunters.

So, what the students of Wilson Middle School in Bozeman, Mont., had to say was very encouraging to us. These youngsters are not concerned with hunting, which they consider a means of controlling the game population, but with the loss of grazing land, clean air and clean water on which the animals depend. They pointed out that "wildlife is a renewable resource," and "habitat is not."

Wilson Middle School received a personal letter of congratulations from Fish and Game Director, Wes Woodgerd, for the action. "It's refreshing to occasionally see that some people understand and acknowledge the basic ecological concepts relating to our environment and our wildlife," Woodgerd told the students.

"It's particularly enlightening to hear this from students such as yours, and I can't help but feel that such concern will certainly help in solving some of the problems we face in future years both here in Montana and in the nation."

And, now, we at MO add our bit of thanks to these students for obviously understanding the basics of sound wildlife management.

In closing, I suppose this story may have a moral. Students from highly populated areas where few hunt had serious objections to the sport. But, here in Montana where hunting is still a dominant recreational pursuit, the students understood perfectly.

SPRINGBOARD

At any one time in North America, there are two million automobiles idling at red lights. At an average of 100 horsepower per car, that's equivalent to 200,000,000 horses jumping up and down all the time, going nowhere.

The standard piston engine in automobiles is 15 per cent efficient.

The turbine engine is 30 per cent efficient.

The jet engine is 60 per cent efficient.

The fuel cell is 80 per cent efficient.

The water wheel is 90 per cent efficient.

There isn't any energy crisis. It's simply a crisis of ignorance.—*Buckminster Fuller, a noted energy expert; reported by the National Wildlife Federation*

FOR DISCUSSION

A FEW BURNING QUESTIONS ABOUT GASOLINE CONSUMPTION

Could it be that new cars are *purposely* being made to burn excessive amounts of gas? Back in 1970, the general public was emphatically in favor of a pollution-free engine. But now that it's hitting where it hurts most—in the pocketbook—how many do you suppose would favor revocation of the Clean Air Act of 1970?

And along that line, is the environmental damage worse from

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auto emissions or from the vastly inflated use of our fossil fuels—a use which completely alters an area's productivity for both man and wildlife? Is this a "tactic" by the auto industry to win the public's approval for continued use of the inefficient internal combustion engine? Is this indication of a future move to remove from the books one of the most stringent pieces of environmental legislation ever passed?

REPRINTS AVAILABLE

Reprints of "The Wild Missouri" article (page 19) are available by writing to the Recreation and Parks Division, Department of Fish and Game; Helena, MT 59601.

NEW SPECIES

We've all heard about the bad environmental aspects of the big recreational land grab — disappearing wildlife lands or fishing streams, pollution, overzealous road building, etc.

But here's a new one.

The land speculators are also seriously affecting the highway sign industry, or at least that's what the Sierra Club tells us. In many forested areas planned for subdivision, "deer crossing" signs are all being replaced to read "salesmen crossing."

WHO NEEDS A WATCHDOG?

Henry Wimburg of Phoenix, Ariz., was convicted of raising four geese in his relatively small yard. (A city ordinance says he must have 10,000 square feet to keep any animals except household pets.)

He's not satisfied with the de-

COAL QUICKIES

We keep writing about strip miners in eastern Montana and, as one reader pointed out, fail to identify them. So here's a breakdown.

The four present strippers of Montana coal are: (1) Western Energy, a wholly owned Montana Power subsidiary, near Colstrip; (2) Peabody Coal Co., near Colstrip; (3) Decker Coal Co., near Decker and very close to the Montana-Wyoming border, and (4) Knife River Coal Co., near Savage.

The next operations due to open are: (1) Westmoreland Resources in Sarpy Creek, north of Hardin; (2) Consolidation Coal Co., in the Bull Mountains near Roundup or in Sarpy Creek and (3) Peabody Coal Co., on the Northern Cheyenne Indian Reservation.

Other coal and energy companies involved in exploration and/or leasing of coal in the Fort Union fields are American Metals Climax (AMAX), Big Horn Coal Co., Burlington Northern, Valley Camp Coal, Atlantic Richfield, Shell Oil, Mobil, North American Coal, Pacific Power & Light, Humble Oil and Refining, Gulf Mineral resources and Chevron, according to the Montana Environmental Quality Council.

And the Montana Division of Planning and Economic Development tells us that at least three more—Colorado Interstate Gas Co., Northern Natural Gas Co. and Norsworthy and Reger, Inc.—are similarly "interested in Montana coal."

Be sure to pick up a copy of "Coal Development in Eastern Montana," a situation report of the Montana Coal Task Force. It answers a lot of questions. It's available from Frank Culver, Department of Natural Resources and Conservation; Helena, MT 59601.

"Strip mining, while it is going on, looks like the devil, but . . . if you look at what these mountains were doing before this stripping, they were just growing trees that were not even being harvested!"—*Audrey J. Wagner, chairman of the board, Tennessee Valley Authority*

The Sierra Club has suggested a unique designation, THE ORDER OF THE BLOWN FUSE, for those who devise the most effective ways to expand the consumption of energy. We nominate the utility industry for its relentless drive to put a lawn light in every yard.

Carl Bagge of the National Coal Association says the coal industry could easily relieve the present fuel and diesel oil shortage. How? By allowing utilities to burn readily available coal supplies, which are, in many cases, high in sulfur.

"Electric utilities in many parts of the nation," Bagge notes, "have advised our association that they would convert to coal (from oil) immediately if they were permitted to do so by modification of present severely stringent standards imposed in many states under the provisions of the Clean Air Act of 1970."

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cision, however, and is appealing it, claiming the birds were "watch geese."

THREE MONTANANS RECEIVE COVETED ROMCOE AWARDS

This year two of seven of the highly coveted ROMCOE awards for outstanding achievement went to Montanans.

The ROMCOE awards, distributed by the Rocky Mountain Center on Environment, went to Elizabeth and Eldon Smith and John Goers.

Eldon Smith

Elizabeth Smith

John Goers

The Smiths received the special Hillard Memorial Award, in memory of Edward Hobbs Hillard, Jr. This honor goes to the outstanding individual or group out of all those nominated. Eldon has been an extension wildlife specialist at Montana State University for 18 years, and his wife has remained active in various environmental activities. Or, as a ROMCOE news release put it, "There is no significant environmental question in Montana in which the Smiths have not been involved."

Goers, reclamation administrator for the Montana Department of State Lands, was honored in the "government" category. He has been in his current position for only two years, but that was obviously time enough in which to prove himself. John is described by one of his colleagues as "one of the few men in this country in such a position totally dedicated to the preservation and restoration of the environment."

NEW COMMISSIONERS

Arthur C. Hagenston

W. Leslie Pengelly

Arthur C. Hagenston and W. Leslie Pengelly were appointed to the Montana Fish and Game Commission in January 1973 by Governor Thomas L. Judge.

Hagenston, a native of Watertown, S.D., has owned and managed Hagenston's Hardware in Glendive since 1946. He is a director of the Montana Hardware and Implement Association.

A member of the Constitutional Convention Study Commission, he is also past chairman of the Dawson County High School Board and served on hospital and Chamber of Commerce boards in Glendive. Other activities include the Eastern Montana Shrine Club, Masons, Loyal Order of the Moose and Glendive Lodge No. 1329 BPOE (Elks).

Hagenston served in the U.S. Air Force from 1943-46 and was a member of the Montana National Guard. He attended Dawson County Junior College.

He and his wife, Edith, have three children. Hagenston replaced Carl Harbaugh, Sr., Jordan.

After nine years as director of the University of Montana Wildlife Extension unit, Pengelly was appointed in 1963 as professor of wildlife management in the School of Forestry. He earned a B.A. in biology from Northern Michigan University, his M.S. from the University of Michigan and his Ph.D. from Utah State University, both in wildlife conservation.

Pengelly is a member of the Montana Wildlife Federation, the Wilderness Society, the Wildlife Society and several academic and scientific honoraries. He is past vice president of the Montana Wilderness Association.

Pengelly received outstanding service awards from the Idaho and Montana Wildlife Federations, in 1955 and 1962, respectively. In 1967 he received one of ten awards given annually by American Motors to outstanding professional conservationists. In 1972 he was given an Outstanding Educator of America award for civic and professional contributions. In March he was given the 1973 Einarsen award by the Northwest Section of the Wildlife Society for contributions to the wildlife field.

He and his wife, Mary, have six children. Pengelly was appointed to the Commission to replace Jack Cohn, Helena.

editorial

KEEP THE RIVER WILD

This issue contains a cover article on central Montana's Missouri River. The author, Dick Ellis, describes the 170-mile stretch of river between Fort Benton and the headwaters of Fort Peck Reservoir from a floater's point of view—what to take, what you'll see and how to do it. Those who enjoy outings in remote and essentially unaltered places should make the trip. The tranquility and timelessness of the "wild Missouri" guarantees relaxation.

The Missouri is nothing new to these pages. Department interest in maintaining this part of the river in its present, unaltered state began several decades ago. Since that time, directors, commissions and personnel have emphasized the need for some form of protection time and again, in articles, programs and at meetings. Why? Greedy eyes view the "last of the wild Missouri" as merely another location for unwanted and unneeded development—dams, subdivisions or whatever.

The river needs and deserves protection. With this in mind, the Montana Fish and Game Commission designated the Missouri as one of several "Recreational Waterways" in 1966. Since passage of the federal "Wild and Scenic Rivers Act" in 1968, the department has supported efforts to include the Missouri under provisions of the act. More recently, the department supported Senator Metcalf's bill (SB 1405) to establish the Missouri Breaks Scenic Recreation River. And, during the recent session of the Montana legislature, House Bill 133, designed to preserve the Missouri's "free-flowing, natural and scenic condition," received department backing.

So far, all this effort, both by the department and a multitude of other individuals and organizations, has resulted in nothing more than that— effort. From the variety of proposals so far advocated, not one has yet been initiated. House Bill 133 is shelved until the 1974 session of the Montana legislature; Metcalf's SB 1405 is dormant; the over-all impetus to protect this important Montana river appears to be quelled.

So, what's next, you might ask? Do we forget about this most unique of Montana wild rivers, or do we continue the battle for some form of protection?

One thing is sure: those who expound the questionable philosophy, "use it or lose it" in reference to Montana water, still promote the idea of an ill-advised monument to man's destructive and shortsighted abilities at Cow Creek (a proposed dam site). Proponents of this philosophy insult the intelligence of most people, since they fail to tell the entire story. Once a dam fills, the water passes through and on downstream anyway. And, the short-term gains to the economy of an area during construction are just that—supposed benefits which, after construction, leave the area with a large body of nearly sterile water and an economy in about the same condition.

With the development of southeastern Montana coal reserves and associated power plant construction, any additional hydro project on the Missouri appears as nothing more than a devoted effort by a few narrow-minded people to remove for all time one of the last vestiges of native and natural river environment in Montana. Then consider the fact that such projects now typify an outdated way of producing power. Hydroelectric generating facilities (dams) produce only about four per cent of the nation's power demand at present.

This department does not oppose all development projects in Montana. We do, however, oppose attempts to foister on the public single-use projects such as High Cow Creek dam, which not only will destroy wildlife habitat, but other important values as well.

Recently, some charged that this department opposed plans for a bridge over the Missouri near the present site of the Lohse-PN Ferry. The record shows, however, that the Fish and Game Commission officially supported such plans both in writing and verbally at hearings in Big Sandy and Winifred during March, 1973. The placement of the bridge and connecting spur roads may adversely affect the department's Judith Landing Recreation Area, but, to date, these details remain unresolved.

The fact is we support the concept of a bridge because it would represent an acceptable alternative to construction of the dam, at least for purposes of travel to trade centers such as Lewistown.

Man's activities have substituted artificial structures for a natural environment along nearly all of the Missouri River's 2,500-mile course through our nation. In Montana, we're fortunate to have the *last* remaining stretch of the "wild" Missouri, unaltered, free-flowing and deserving of our attention. Let's keep it that way.—*Steve Bayless*

MONTANA COAL--part three

by Bill Schneider

putting montana back together again

EDITOR'S NOTE—The following article is the third in our "Montana coal" series. Like most aspects of the coal/energy situation, land reclamation becomes very complex and, at times, confusing with many questions remaining unanswered. The effect on wildlife is especially unclear—to cite one example.

In the next issue, the last article in this series will cover the effect of coal development on the area's cultural, archaeological and historical values.

THE LEGISLATORS, WEARY from many fiery debates and long hours have gone home now. While in Helena, they attempted to answer many vital questions, one of which was, "Is the complete reclamation of strip mined land possible?"

After weeks of study including many public listening sessions, the lawmakers obviously decided it was. They left for home with a new law—the Montana Strip Mining and Reclamation Act of 1973—on the lawbooks.

But as is the case in all controversies, not everyone thought it was the correct choice. Mrs. Vera-Beth Johnson, a member of the Northern Plains Resource Council (a newly formed environmental group) from Roundup, is one of those. Last year, she told the U.S. House Interior and Insular Affairs Committee that her land, the Bull Mountains, was a "God-created beauty" that can "never be replaced by man." Her conclusion, and that of many of the area residents, was that the scenic beauty and productivity of the land could never be completely restored. So, it should not be stripped. She asked the congressmen, "Do we have so much earth that we can afford to destroy forever any part of it?"

Others, like John Goers, reclamation specialist for the Montana Department of State Lands, feel proper reclamation is conceivable. He does, however, qualify that by saying, "Some sites can be reclaimed only if mining methods are changed to bury all toxic overburden." But, on the other hand, he doubts if "some sites can be reclaimed at all."

The industry, as is predictable, insists reclamation can be achieved. Tom Gwynn, often a spokesman for the coal industry, told the legislature that his company—Knife River Coal Co.—has been reclaiming its spoils for years and will continue to do so even if it isn't required. And, Pemberton Hutchinson, of Westmoreland Resources (due to open a mine on Sarpy Creek, north of Hardin, in April 1974) considers reclamation as a required step of any mining operation. He said, "It (the strip mining) will be done right, or it won't be done."

During the legislature, newly elected governor, Tom Judge, (along with several others) assured the public that Montana would have "the strongest strip mine reclamation law in the nation." The Governor backed up his position with a commitment to support a moratorium on coal development, if such a law (and power plant siting bill) was not passed. And, following suit, the legislature—the voice of the people—delivered. Time will tell if the new legislation is *the* "strongest" in the nation, but certainly, it's a much better law than its predecessor.

(The act is long and like most legislation, packed with detailed legal rhetoric. So, rather than attempt to explain it specifically, we've summarized it on page 17.)

vital issue or Trojan horse?

Alarming as it may sound to

some, reclamation has been called a "Trojan horse" meaning that it's not all that it appears to be. This refers to the false logic that "if we pass a tough reclamation law, everything will be all right." When one contemplates the vastness of the coal situation —which is, in turn, the national energy situation—it becomes very clear that widespread environmental damage can still occur regardless of how tight the reclamation laws are.

Supporters of the Trojan horse theory insist land restoration gets too much of the political spotlight when other aspects of coal development are more serious. A few examples named are: (1) the possible pollution problem from 20 or so giant coal-burning power plants planned for the region, some of which will be 3½ times as large as the famous polluter—the Four Corners plant, near Farmington, New Mexico, (2) the unknown socioeconomic impact of adding a possible 300,000 or so new people to what is now a sparsely populated region, (3) the proper siting of power plants, transmission lines, railroad spurs, water diversions and other facilities that come with the coal extraction, (4) the possible drying, diverting and/or damming of the mighty Yellowstone River and (5) the potential increased burden on taxpayers in coal-rich counties.

Certainly, all these (and others not listed) are critical problems and need attention. The coal issue is so complex that no single action could solve it all.

But Montana *is going to have strip mining.* The legislature decided that when they killed a bill introduced by Barbara Bennetts (D-Helena) to abolish coal stripping and another sponsored by Dorothy Bradley (D-Bozeman) to declare a three-year moratorium on coal development. And, strip mining requires close regulation, so working under the premise that there will be coal stripping, the legislators acted wisely and gave Montana a good law.

So, as it stands right now, total land reclamation is a very vital issue. Care must be taken, however, to avoid letting reclamation become a "cure-all" for every environmental ill that coal development threatens to bring to Montana.

it can be done

Reclamation work in several European countries proves—without a doubt—that land can be completely restored. However, stiffer restrictions than any even mentioned in the Montana legislation are standard procedure.

European officials require the salvage and segregation of *all* layers of overburden and the replacement layer by layer in the exact same order. When finished, a mine site looks exactly like it did before mining—right down to the smallest contour and number and type of plant species.

However, such a complete reclamation job can't be found in this nation. But, there's no reason why it can't happen here, given the necessary expenditures (e. g. up to $5,000 per acre) by the coal companies.

the economics of reclamation

At first, $5,000 per acre sounds like a ridiculously high price for reclamation, and except for a few very extreme cases, that many dollars won't be needed in Montana. Coal companies expect reclamation to follow their stripping shovels, but they don't like spending so much for it. High expenditures will, however, be needed to put the land back together again.

Reclamation bonding requirements of the 1973 law are a minimum of $200/acre and maximum of $2,500/acre. Spending only $200 per acre is a joke, but in most cases, a $2,500 per acre expenditure may bring the land back to productivity.

But should a limit be set on reclamation costs? Would a better philosophy be—continue reclaiming efforts until the land is put back to its original productivity and *not* until some monetary limit is reached? Should reclamation stop when $2,500 is spent and leave the land partly reclaimed?

Goers feels confident that no site will be left partly reclaimed because the reclamation bond "ran out." Efforts will continue "regardless," he said.

The reclamation specialist insists proper reclamation can occur "without noticeably affecting the pocketbooks of the coal companies or those who use the power the coal produces." And, he has figures to back it up. For example, reclamation expenses of $1,000 per acre cost the stripper only 2.6 cents per ton on a 24-foot seam at Colstrip and only 1.2 cents per ton on a 52-foot seam at Decker or Sarpy Creek.

(In the chart on page 19, the Department of State Lands figures the cost-per-ton by assuming one acre-foot of coal contains about 1,760 tons.) These cost-per-ton expenditures are pitifully low compared to reclamation costs in Europe. In Great Britain, for example, reclamation and rehabilitation costs on strip mined lands average $1.35 per ton. Some operations range up to $3.83 per ton. A far cry from Montana's reclamation costs, right?

The coal situation like the energy situation is a numbers game. But even the shortest venture in-

IS THE COMPLETE RESTORATION OF STRIP MINED LANDS REALLY POSSIBLE?

Montana Coal continued

to the number jungle reveals the tremendous wealth involved. The Decker Coal Co. is stripping a 52-foot seam containing approximately 91,520 tons per acre (1,760 x 52). Assuming the going price was $2.50 per ton (a conservative figure), the total worth of *one acre* is $228,800. Using a 24-foot seam, each acre yields $105,600 for the coal stripper. So, considering how much each acre of coal land is worth, $1,000 or even $5,000 per acre for reclamation doesn't seem like a whole lot.

Granted, it takes a large investment to launch a strip mining operation, but the fact remains that the cost of reclamation is minor compared with the profits involved. The Montana Coal Task Force also pointed this out in their excellent report. "For Montana coal mines," the report states, "reclamation costs are only a few cents a ton. The United Mine Workers' Pension Plan takes 20 to 40 cents per ton on certain mine sites and railroad freight rates to midwestern power plants reportedly range between six and eight dollars per ton. Therefore, reclamation costs obviously are not prohibitive."

where reclamation begins

Reclamation does *not* begin after the coal has been extracted and the bare spoils exposed. It starts approximately two years before the first shovel of topsoil is turned.

A large bank of facts is absolutely essential in preparing a workable reclamation plan. For it's what you *don't know* about the land to be stripped that can cause its incomplete reclamation.

Goers warns that any reclamation plan containing little factual information and inadequate advance planning will probably be denied by his division. So, it behooves the stripper to start planning for reclamation at the same time (maybe even before) final plans for the mine are made. Goers advises the miner to "figure out how the land can be reclaimed, and then work from that point, instead of planning land restoration after the mining method has been finalized."

"Reclamation comes first," he said, "and if they (the coal strippers) can't figure out how to do a complete job, then the permit won't be approved. The new legislation makes it clear that if the environment can't be repaired, the site can't be mined."

The mechanics of reclamation create many problems. A few are: (1) what to do with the first spoils from the first cut (see drawing, page 16), (2) how to reduce the highwall without uprooting more land than is actually mined, (3) how to assure adequate compaction of spoils, (4) how to prevent toxic soil types from remaining on or near the surface, (5) what to do when the coal seam is the aquifer and ground water tables are severed and (6) how to assure proper grading along haul roads set deeply in the spoils.

Goers, who will be largely responsible for approving (or disapproving) reclamation contracts, feels these problems can usually be solved. It will, however, depend on how serious miners are about their reclamation responsibilities.

It may leave a very bitter taste in the mouths of some people who benefit financially from the coal extraction, but they must accept the reality that some coal land can't be completely reclaimed, so it will *never* be stripped. The coal strippers simply will have to turn their backs on a known coal deposit, leaving it there forever.

what is reclamation?

Believe it or not, one stumbling block on the road to complete restoration of the stripped land

MINI-EDITORIAL

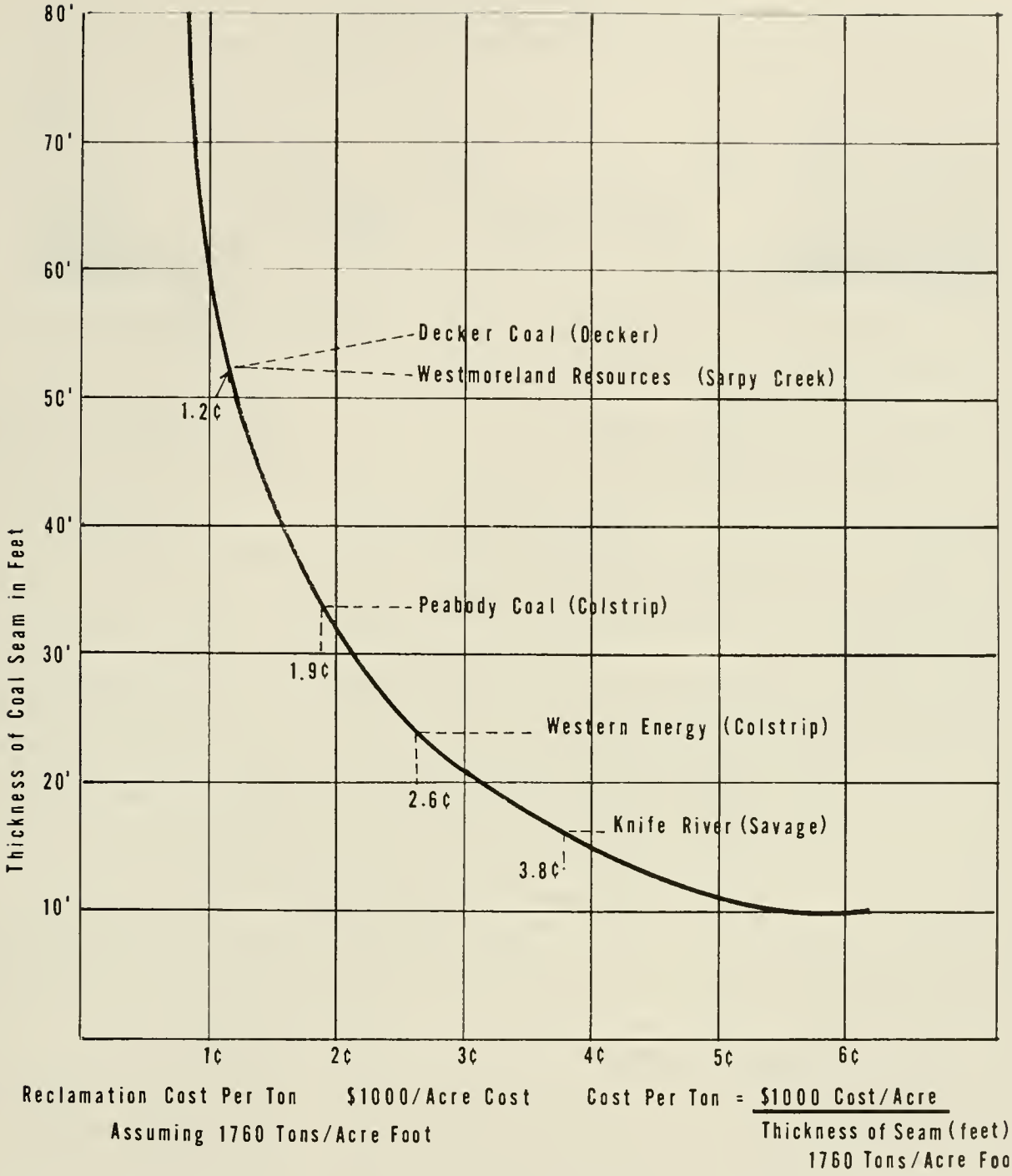
We're encouraged by some recent actions of a few major industries interested in Montana's mineral wealth. And, we want you to know.

Specificallly, they are: (1) cooperation by Consolidation Coal Co. (Consol), American Metals Climax (AMAX) and the Anaconda Co. in fish and wildlife research in areas of potential extensive mineral development, (2) Montana Power Company voluntarily changing its philosophy on advertising to energy conservation instead of those absolutely ridiculous ads promoting the use of more electricity and (3) the Burlington Northern railroad attempting reclamation on 30-year-old strip mine spoils when it was not legally required to do so.

In the future, such cooperation—financial and otherwise—from the industry will be needed, regardless of how strict the laws are. For example, there's no way enforcement of reclamation and plant siting legislation can be totally effective without some cooperation from the industries involved. And, we're not just talking about coal. Other mineral extraction can also be devastating.

The industry must consider environmental protection their o b l i g a t i o n, not something they're forced to do by "extreme environmentalists." If the companies still cling to the "do no more than we're forced to, and then try to get around that" philosophy, Montana's future looks very dismal. Very dismal, indeed.

Right now, we're somewhat optimistic, and look for this short list of voluntary actions to grow longer. We do, however, reserve the right to change our minds at a later date.

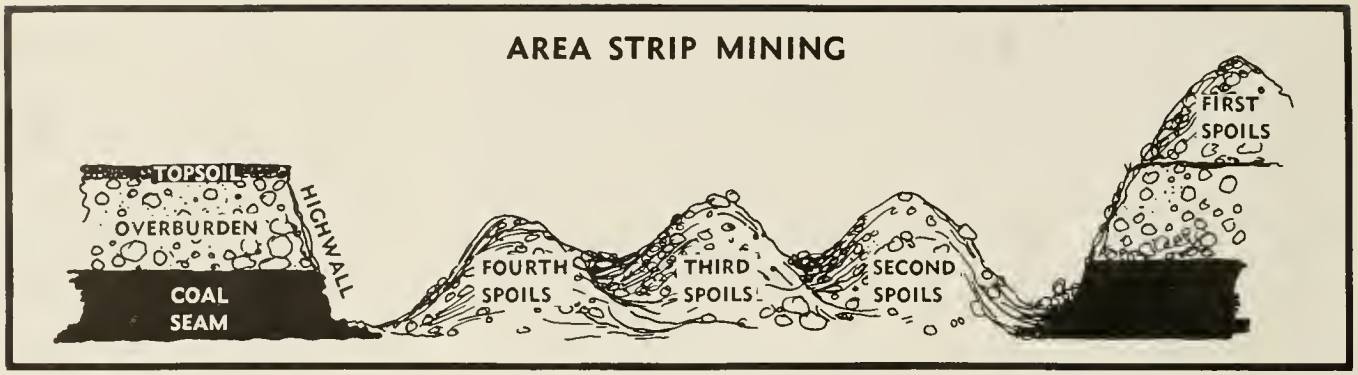


is defining reclamation. The new law defines it as "Backfilling, grading, highwall reduction, topsoiling, planting, revegetation and other work to restore an area of land affected by strip mining under a plan approved by the Department [of State Lands]."

As this goes to press, the Department of State Lands is writing regulations to enforce the new law. Here is where the department can assure Montanans that all strip mined land will be returned to its original use.

Legislative debates in Washington, D. C., Montana and other states have unearthed many de-

THE FACT IS-NOBODY KNOWS HOW STRIP MINING AND LAND RECLAMATION WILL AFFECT WILDLIFE.



Montana Coal continued

finitions. Some supported by industry are actually humorous, such as "restored in such a manner as to not cause unreasonable pollution or siltation," or "reclamation efforts will be made where practicable." Fortunately, our legislators spotted these interpretations for what they are—*nothing*—and wouldn't allow them in Montana's legislation.

reclaimed land for wildlife

When the Department of State Lands writes its new regulations, one of the productive uses of the reclaimed land will be wildlife habitat. In fact, most of the land to be stripped will, after mining, be either livestock grazing land or wildlife habitat.

This is not to say that classifying reclaimed land as wildlife habitat would be bad. But great care must be taken not to let the land become wildlife habitat just because it can't qualify for anything else. Habitat means a complex combination of climatic, topographic and vegetative types that function together for the benefit of a certain wildlife species and provide all its life essentials. For another species, the requirements may be completely different, but equally diverse.

"Diversity" is the key word. Wildlife is a product of diverse conditions, not simple ones. And, that's especially true when discussing plant requirements. Wildlife needs a complex set of specific vegetative types, almost exclusively perennials.

To date, most plantings on reclamation sites haven't provided this diversity. Most sites host primarily exotics (plants not native to the area) such as Sudan grass, alfalfa and crested wheatgrass. Although of some use to livestock, these plants have little value for wildlife. In fact, exotic species tend to "take over," precluding native plants valuable to wildlife and creating "monocultures" (plant communities containing only one or a very few species). Such monocultures are of very little real value to wildlife and many don't even offer much for domestic livestock.

Just because a reclaimed field is green, looks "nice" and with excessive fertilization and irrigation can produce 30 bushels per acre of winter wheat, it doesn't mean all is well. It may not continue on a long term basis, and its worth as wildlife habitat is still a big question mark. A field mouse darting through the open space between stalks of alfalfa or a deer bounding across 10 acres of Sudan grass doesn't make it wildlife habitat.

One fact comes through loud and clear when assessing the effect of reclamation on wildlife. That is—*nobody knows what will happen.*

Southeastern Montana's abundant wildlife must return after mining. It is as much a part of the western heritage as small town general stores, white-faced cows and the scenic prairie itself.

(For more on coal development and wildlife, refer to Montana Coal—part two in the March/April 1973 issue of MONTANA OUTDOORS.)

some reclamation useless

In the final analysis, reclamation can happen on some sites with adequate cooperation and control. But, *it hasn't happened as yet.* In a very few years, Montanas will know if their state will indeed be restored or if natural and cultural values will be destroyed forever.

Kentucky and West Virginia have suffered and now have strict reclamation regulations. But, according to Sierra Club studies, enforcement has been ineffective. In Pennsylvania, which also claims to have "the strongest law in the nation," damage from stripping has actually grown since the law was passed in 1967. *Will this happen here?*

In Montana, some areas *can't* be reclaimed to their pre-mining state, so under the selective denial section of the new law, *they can't be stripped.* They must not be.

The Bull Mountains, south of

CAN THE COAL STRIPPER'S OBLIGATION TO RESTORE THE LAND BE MEASURED IN DOLLARS?

THE MONTANA STRIP MINING AND RECLAMATION ACT OF 1973	THE MONTANA OPEN CUT OR STRIP MINED LAND RECLAMATION ACT OF 1971
Selective denial where circumstances warrant.	State may not deny right to mine.
Permit system, permit good for 1 year only.	Reclamation "contract" good until cancelled by mutual consent.
Authority to regulate mining in precipitous terrain.	No control of mining on steep slopes.
Control of entire method of operations.	Control of reclamation plan only.
Maximum bond to insure reclamation is $2,500 per acre.	Maximum bond — $1,000 per acre.
Authority to immediately halt any operation in serious violation of the law.	Must resort to lengthy legal process to attempt to halt an operation.
Suitable vegetative cover must be established or bond forfeited.	Only two attempts at seeding required.
Statutory authority for contour grading and topsoiling.	Only best reclamation procedures available under the circumstances required.
Violator of law subject to $1,000/day fine, forfeiture of bond, and revocation of permit.	Violator of contract may be sued by state for breach of contract and payment of bond.
Authority to deny permit to repeated violators.	State may not deny right to mine.
Restoration of land must be kept current.	Reclamation to be as current as feasible.
Contour strip mining banned.	No control of mining methods.
Citizens may bring suit to see that law is enforced.	No related provision.
Citizens may recover for damages to ground water supply.	No related provision.
A surface owner may recover from an operator for damages from contaminated water draining from the operation.	No related provision.

Roundup, provide an excellent example of an area that must be either carefully mined or, at times, not mined at all. The mining could be the contour type, the method which left Appalachia in ruin. But, fortunately, the new law doesn't allow this most destructive type of strip mining, and therefore prevents devastation of some parts of the scenic Bull Mountains. However, other parts of that mountain range might be stripped by the less destructive area stripping method.

Unlike most feature articles on serious environmental problems, this one closes without a plea. It doesn't ask readers to immediately do this or that. It suggests Montanans just sit back, wait and *watch*.

Keep a critical eye on all aspects of strip mined land reclamation. If the land and the people are treated fairly, maybe Montanans can live with coal stripping. But, if things go sour in the mines, if native Montanans become outcasts on their own land, if regulation is weak, if government starts turning the other cheek, or if the tragedy of Appalachia begins "coming true again" here, the *stripping must cease*.

And there are at least three ways it can be stopped. The 1973 law contains two routes for those wishing to halt (or prevent) a specific stripping operation. They are: (1) the selective denial section which gives the state the power to deny a mining operation, and (2) the mandamus provision which allows citizens to sue state officials to assure the law is enforced.

The third method, a necessary move if all doesn't go well, is abolition of surface mining in Montana. That action was only "toyed with" this year, but if it becomes obvious that Montana can't be put back together again, it must be revived and made a reality.

Reclamation of Arid Western Lands

by Robert R. Curry

EDITOR'S NOTE — Unfortunately, Bob Curry's testimony given to the U.S. Senate Interior Committee reached my desk shortly after press time for this issue. However, we were able to slip in the following excerpts. For the complete testimony, contact MONTANA OUTDOORS or the author.

Bob Curry is an associate professor of environmental geology at the University of Montana. He holds a Ph.D. in geology and geophysics and has considerable graduate training in plant ecology.

SPECIFICALLY, THESE COMMENTS apply to areas of the conterminous United States where present potential ground-level evaporation during a given year exceeds, on the average, total precipitation at ground level for that year. This includes virtually all areas in the West where open-pit or strip mining is now going on or is contemplated.

I estimate that over 95 per cent of the economically recoverable fossile resources of western United States, such as coal, oil shale, and natural gas are found in these arid areas, as well as the vast bulk of the economically recoverable gravels, gypsum, bentonite, copper, uranium and other potentially strip mined or surface mined deposits.

Reclamation conditions, procedures, and successes in eastern United States, particularly in Appalachia, have no bearing on conditions to be expected in western United States. The situations are wholly different. I have visited and studied eastern reclamation and am impressed with the few partially successful efforts I have seen. All of the extensively surface mined areas of the east such as Kentucky, West Virginia, southwestern Indiana, southeastern Illinois, and much of Pennsylvania are characterized by having deep residual soils and high rates of mineral weathering. This has permitted the development of reclamation techniques such as stockpiling soils for reapplication to abandoned disturbed areas, broadcast hydroseeding,. recontouring of mined areas and forms of replanting that have at times had some success. I now see many of these same techniques being contemplated and even used in the arid West, apparently based on little more than the measures of success in the East. This is disasterous.

Reclamation in the West differs from that in the East primarily because of aridity during at least summer months, and because the ages of the land surfaces in the West are much less than those generally found in the surface mine areas of the South and East. For instance, the hill slopes of much of Appalachia, with precipitation to evaporation rates of 4:1, have been developing since mid-Tertiary geologic time, 20 to 30 million years ago. Eastern Montana, on the other hand, with a precipitation to evaporation ratio of about 1:10, possesses a weathering profile but 5 to 15 thousands years of age. The Four Corners area of northeastern Arizona has a precipitation to evaporation ratio of 1:50 or more, virtually precluding any hydrolytic mineral weathering under present climatic conditions. What this means is that the ground surface, once disturbed, cannot recover to the present state of succession or subclimax without extremely long periods of geologic time—many times longer than we expect man to inhabit the earth.

In recent years geologists, soil scientists, and paleoclimatologists have learned that over much of the arid West there appears to have been brief geologic periods favorable for soil formation. Today, many of these soils are not forming and cannot under present climatic conditions.

In the East the deep Tertiary weathering profiles have yielded soil materials 100 or more feet in depth and relatively homogeneous throughout with the exception of the organic rich top few feet. Much strip and contour mined land in the Southeast has merely to be recontoured and a few feet of the weathered mantle bulldozed over the surface to be able to support a sometimes lush vegetative cover where acid drainage is controlled, fertilizers are used and seeding is careful. In the West, the total soil depths (and easterners would not even call much of our plant-supporting media, "soil") are on the order of inches and zonation of minerals and living plant and animal matter is extreme. Stockpiling soil and recovering the lands for reclamation may in some cases do more harm than good, where for instance the calcium carbonate layer underlaying much arid land soil is mixed with the nitrogen rich organic layer and the biologic carbon-nitrogen balance destroyed.

In arid lands, where evaporation exceeds precipitation, the soil acts like a great wick. It is a well-known practice of analytical chemistry to place a strip of filter paper in a solution of chemical compounds to be separated and to let those compounds wick up the filter paper, ultimately to be deposited at various levels above the water surface with each chemical species at its particular predictable level. The same happens in soil in arid regions resulting in a delicately balanced biogeochemical segregation within the soil profile. To destroy this segregation by homogenizing the top few feet of substrate is most often counterproductive from the biologic point of view, as is witnessed by those attempting to till land in arid regions and finding that progressively higher fertilizer and gypsum treatments are necessary and that ultimately production ceases unless soils can be leached with artificially developed water sources.

In the East, where fresh, unweathered geologic materials are brought to the surface in rare cases and reclamation must proceed without benefit of soil materials, the warm temperatures coupled with high summer humidity and high ground moisture levels permit some species of plants to survive and to produce their own soil in periods of time as short as a human lifetime. However, in the West, unless precious water is imported and the sites are watered for 200 to 2000 years to simulate the naturally wetter conditions during the soil-forming periods, reclamation to the point of self-sustenance is impossible.

Water is undoubtedly the key to reclamation in the West. To recover a viable vegetative covering and to protect surface and ground water quality which is of the utmost value in the West, it will generally be necessary to water and fertilize carefully the areas being reclaimed. The costs of this water and the costs of the long periods of time necessary to facilitate self-sustenance must be borne in mind by those contemplating reclamation, but I can nowhere in the West find evidence of internalization of these high costs. Since the weathering processes are so much slower than in the East, times for successful reclamation in the West are very long and specialized land management must be practiced many decades to centuries at minimum. Introduction of water and fertilization to the immature soils of the West will result in the growth of highly palatable forbs that will tend to concentrate grazing animals, both wild and domestic, in the areas undergoing reclamation for at least the first century after these efforts are under way. This places an additional burden on the land and those involved in reclamation, requiring the range managers to fence reclaiming areas for long times to restrict grazing pressures.

In my opinion, the times allowed for reclamation or the monies allocated for such reclamation through state legislation in the West are very inadequate. In no instance I can find are present laws applying to western reclamation adequate to insure minimal sustained recovery. When one considers the rising costs of western water and fertilizer and the rising values of maintained water quality, I estimate that costs of reclamation in the West are 10 to 100 times as great as those on steep, contour-stripped lands in the Southeast.

From the energy standpoint, I do not think that the costs are worth the effort. Deep mining of fuels becomes economically more favorable when reclamation costs are truly and accurately considered.

One can be easily misled looking at only the land surface. Restoration of an area to self-sustaining biologic productivity creates a parcel of land that can absorb and collect water free of impurities harmful to man and other species. Thus the watershed values are in many cases greater than those for grazing for the few animal-unit-months. Thus the income from one acre of undisturbed land in the West may be low but the cost to the people of a wide area of one acre of disturbed and unreclaimed land may be high.

In summary, our present research efforts and knowledge of reclamation procedures applicable to arid western United States are wholly inadequate upon which to base measures of success or failure of reclamation efforts.

The Wild Missouri

BY DICK ELLIS

(F&G photo by H. Max Stone)

Canoeing is probably the most popular and enjoyable way to experience the "wildness" of the last remaining unaltered stretch of the Missouri River. (F&G photo by Dick Ellis)

The river and the surrounding lands are made to order for family recreation. (F&G photo by Dick Ellis)

Many scenic stopping places dot the bank. Sometimes, floaters simply camp wherever they happen to be when night falls. (photo by Bob Cooney)

THE COVER STORY

The Wild Missouri . . . has some fun for everyone

CARE TO LAUNCH yourself into a water-borne wilderness trek that will carry you back over 100 years into a realm of exciting history, unsurpassed scenery and restorative solitude? Then why not float the Missouri?

From its birth at the junction of the Madison, Gallatin and Jefferson Rivers, to its mergence with the waters of the Mississippi, the "big muddy" sinuously courses for 2,466 miles. Over the great bulk of its winding, the Missouri has fallen to man's heavy hand. Its once free spirit is impounded behind dams and channeled between levees; its shores are lined with the trappings of civilization. Only one significant stretch remains free, unfettered and unspoiled—the 170-mile portion from Fort Benton downstream to the headwaters of Fort Peck Reservoir.

Once a busy waterway serving explorers, trappers, miners and the military, this section of the Missouri was later by-passed by civilization and now offers a rare opportunity for today's recreationists to escape the pressures of our society.

the trip

The river below Fort Peck is for the most part remote. For about the first 45 miles, civilization still clings tenuously to the river, but as the floater moves past serene bottom land, wooded islands and sloping bluffs, his attention fixes on the natural scene.

The early riser may see antelope, mule deer, whitetail deer, small mammals including beaver, muskrat, coyote and the prairie dog. He may watch eagles soar and see the stately great blue herons, raucous magpies, numerous waterfowl and a wide selection of smaller birds. If he's fortunate, he may also view bighorn sheep in the upper reaches of the Charles M. Russell National Wildlife Range. (The Audubon Bighorn, so commonly seen here by the first explorers, later became extinct.) Sheep seen today are the Rocky Mountain Bighorn, reintroduced in 1965. Only the mighty bison and the fearsome grizzly are missing from the scene. Downstream from Fort Benton, catfish, sauger, goldeye and northern pike lure the fisherman.

Downstream from Virgelle, white sandstone outcroppings begin to dominate and, in places, tower high above the water. The glistening cliffs are studded with pockets of vegetation in various hues of green and

Wildlife abounds along this section of the Missouri. (photo by Alan Nelson)

The wild Missouri at sunrise. (F&G photo by Steve Bayless)

Many scenic views await those who have enjoyed the last unaltered stretch of the mighty Mo. (photo by Bob Cooney)

brown, and their bases rest on slopes of blue-gray sage. Stands of cottonwood and poplar shade the islands and river banks. Over the ages, wind and rain have carved the yielding rock into intriguing shapes resembling walls, parapets, castles and columns which have stimulated man's imagination since the first explorers passed here and named this the White Rocks of the Missouri. Here evidence of man is rare, and the scene is little changed from the time when the Missouri was young and there was still a frontier.

Below the White Rocks, the valley widens and denser stands of evergreens appear. Soon the waters of the Judith join the Missouri and for a short while man's works are again present. Below the Judith, floaters soon find themselves entering a more arid section of rugged badlands. Massive products from eons of erosion rise high on either side of the river and the scene is one of harsh and awesome beauty.

As the end of the trip nears, the valley broadens, the bluffs are lower and more distant. Stands of cottonwood dominate the bottom land. Soon, the Fred Robinson Bridge near the head of Fort Peck Reservoir comes into view and the floater must again face the realities of today.

The wild Missouri indeed offers much in its solitude, scenic beauty and abundant wildlife. The joy of boating and camping in this setting is in itself sufficient reward, but there is another appeal that increases the fascination. This is the appeal of history which still lives here.

the history

The Lewis and Clark expedition, famous in the annals of American exploration, reached this stretch of the Missouri in May, 1805, after leaving St. Louis the year before. The long winter had been passed with the Mandans in North Dakota, and the captains were again toiling their way upstream. Between Fort Benton and the head of what is now Fort Peck Reservoir, 14 Lewis and Clark campsites remain much the same today as they were over 150 years ago. The outstanding scenery sparked the imagination of the explorers and Capt. Lewis wrote eloquently about scenes of "visionary enchantment." As the expedition charted its course westward, they gave names to outstanding features and water courses. Many of the names were changed with time, but some such as the Judith River and the Marias River remain. The Marias marks the point where the leaders faced the critical choice of which river to follow. For five days, they explored and deliberated before Capt. Lewis made the momentous decision, contrary to the opinion of most of the party, and continued up the "south river" to ultimate success.

After the Lewis and Clark expedition, the upper reaches of the Missouri were essentially closed by the extreme hostility of the Blackfeet Indians. Not until 1830 was a foothold established by emissaries of the

Cow Island made river travel dangerous for the early steamboats, but today the floater can easily negotiate the mild rapids found here. (F&G photo by Dick Ellis)

Citadel Rock is probably one of the most famous landmarks found along the 170-mile float trip. (photo by Bob Cooney)

The White Rocks section, with its many unusual rock formations, usually lures the floater from his boat for a short hike before continuing down the river. (F&G photo by Dick Ellis)

The Wild Missouri . . . asks only to remain so

American Fur Company. This first successful contact ushered in the establishment of "forts," which served Indians and white traders alike as centers where pelts could be exchanged for clothing, arms, "firewater" and other items. Too often, the traders were dishonest in their transactions and the Indians often came out on the short end of unscrupulous dealings. Forts Piegan, McKenzie, Culbertson and Lewis (later Fort Benton) were established between 1831 and 1844 along the upper Missouri. Their existence was fraught with danger and more than once Indian hostilities forced abandonment. During this period, river travel was dominated by a hardy, independent breed who plied the waters in keelboats, canoes and pirogues, all of which were laboriously poled, pulled or paddled upriver against an incessant current. Sometimes a favorable wind pushed the craft upstream; in later years steam power took over, but for most part getting to the upper Missouri meant backbreaking toil.

One of the outstanding physical features along the river, Citadel Rock, was named during this turbulent period and was mentioned by Prince Maximilian in 1833. This member of European aristocracy noted the landmark on his keelboat journey to Fort McKenzie, and Carl Bodmer, a Swiss artist with Prince Maximilian, sketched and painted Citadel Rock, along with hundreds of other fascinating scenes.

The fur trade unlocked the door to the upper Missouri, but the magic lure of gold thrust it wide open. The discovery of rich gold fields in western Montana and in Idaho started a boom that transformed Fort Benton from a quiet trading post into a riotous commercial terminus. Steamboats laden with all manner of necessities churned their way against currents, rapids, sandbars and hostile Indians to answer the need of a burgeoning populace. The river trade hit its peak about 1867, and at times from 30 to 40 steamboats were on the Missouri between Fort Benton and the mouth of the Yellowstone.

Many names survive from this period to commemorate important landmarks and difficult obstacles encountered by the craft: names such as Coal Banks Landing, where a futile effort was made to use native coal as fuel, and LaBarge Rock, named after Captain Joseph LaBarge, one of the most famous river captains. Numerous rapids such as Pablo, Gallatin and Dauphine were serious obstacles to the heavily laden craft and meant, at the least, delay and inconvenience, and on occasion total disaster.

The difficult passage through dangerous waters at Cow Island and Dauphine Rapids often necessitated

One can't write about the Missouri River without mentioning western history. Here three paintings by artist Carl Bodmer illustrate the historical richness of the wild Missouri.

transfer of cargo to lighter vessels or to freight wagons which lumbered overland to Fort Benton and points beyond. For nearly 30 years steamboats plied the waters of the Missouri, but as railroads pushed westward to assume the burden of transport, the last pages were written in the colorful history of upper Missouri steamboating.

military activity

As activity grew on the Missouri following discovery of gold, so did Indian unrest. In a few years, harassment of Missouri River commerce prompted establishment of military posts at (and above) the mouth of the Yellowstone. Camp Cook—of cottonwood logs with dirt floors and no windows—was built in 1866 about one-half mile above the mouth of the Judith and was the first permanent military establishment in Montana. These marginal quarters and the lure of nearby gold diggings prompted frequent desertions. Frantic action was seen in 1868 when the post was attacked by some 2,500 warriors, but in general life was dull and morale low. In 1870 the camp was abandoned.

Cow Island entered the military arena in 1877. The Nez Perce Indians, under Chief Joseph's leadership, used this ancient crossing near the end of their 1,300-mile fighting retreat from the army. The Indians sent the small military guard scurrying and confiscated what they wanted from a stockpile of army supplies before moving on north up Cow Creek.

For nearly ninety years, from the first explorers to the last steamboat, a part of Montana's history was lived on the upper Missouri. The actors are now gone, but the stage is intact. Here you can share in the drama of the past, seeing in your mind's eye the canoes of Lewis and Clark, and anticipating the appearance of a churning steamboat around the next bend.

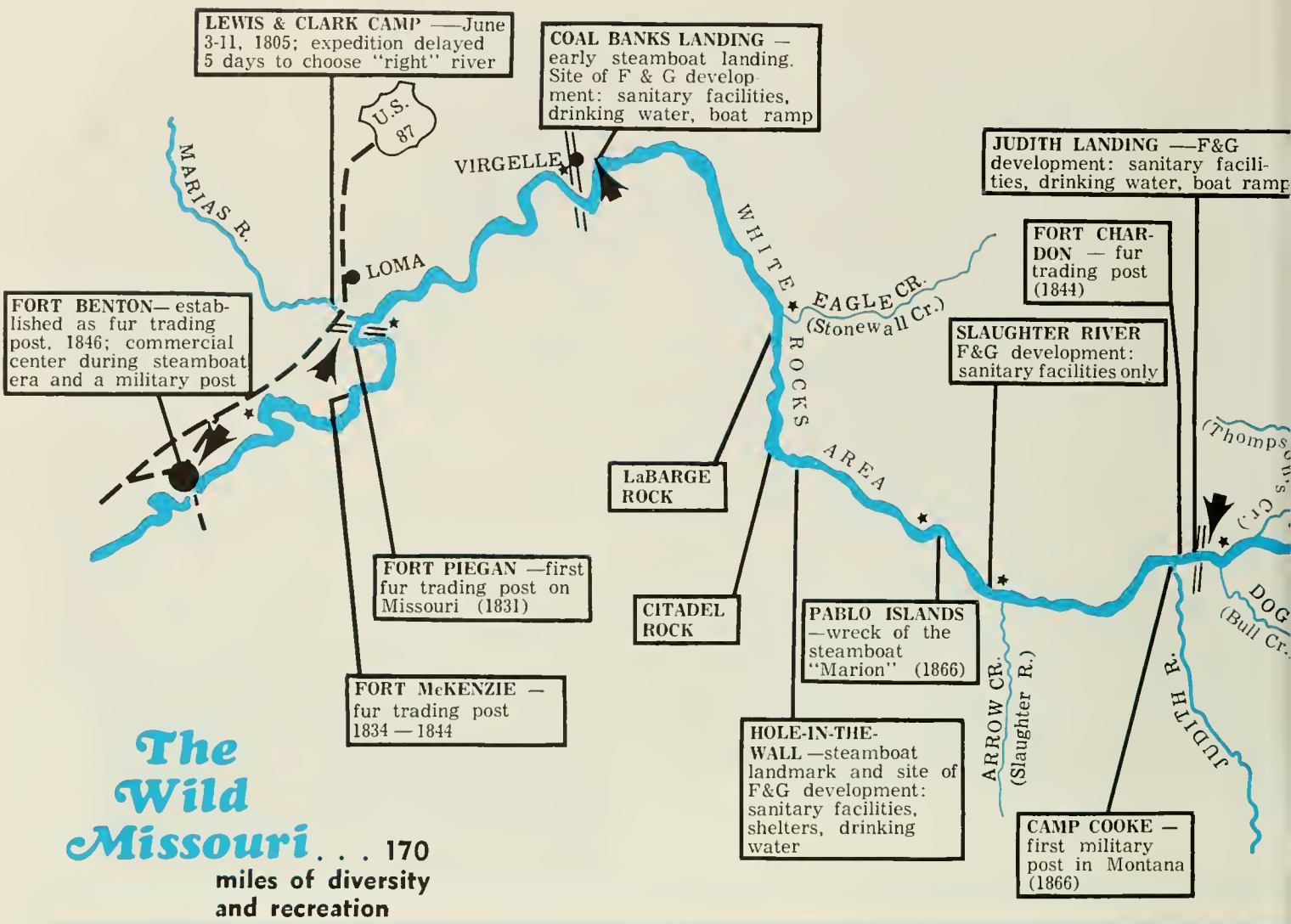
If this brief introduction to the river has stirred a sense of adventure within you, load up your gear and head for the Missouri. As you float, bear in mind that this free stretch of the river has long been a candidate for environmentally unsound and totally destructive big dams. It will remain free-flowing and unaltered only through the support of those who know and love the last remaining wild section of the "big muddy."

Additional information and maps are available through the following sources:

Montana Department of Fish & Game; Helena, MT 59601
Brochure of historical highlights and small-scale river map. No charge.

U.S. Geological Survey, Federal Center; Denver, CO
Large-scale topographical maps of river. Folder describing maps available on request.

Chamber of Commerce; Glasgow, MT 59230
Reprints of 1891 river map, 1 inch = 1 mile scale. Of historical interest and good detail for floaters. Complete set, $4, postage paid.


LEWIS & CLARK CAMP —June 3-11, 1805; expedition delayed 5 days to choose "right" river
COAL BANKS LANDING — early steamboat landing. Site of F & G development: sanitary facilities, drinking water, boat ramp
JUDITH LANDING —F&G development: sanitary facilities, drinking water, boat ramp
FORT CHARDON — fur trading post (1844)
SLAUGHTER RIVER F&G development: sanitary facilities only
FORT BENTON— established as fur trading post, 1846; commercial center during steamboat era and a military post
FORT PIEGAN —first fur trading post on Missouri (1831)
FORT McKENZIE — fur trading post 1834 — 1844
LaBARGE ROCK
CITADEL ROCK
PABLO ISLANDS —wreck of the steamboat "Marion" (1866)
HOLE-IN-THE-WALL —steamboat landmark and site of F&G development: sanitary facilities, shelters, drinking water
CAMP COOKE — first military post in Montana (1866)
U.S. 87
MARIAS R.
VIRGELLE
LOMA
WHITE ROCKS AREA
EAGLE CR. (Stonewall Cr.)
ARROW CR. (Slaughter R.)
JUDITH R.
(Thompson's Cr.)
DOG (Bull Cr.)

The Wild Missouri . . . 170 miles of diversity and recreation

TIPS FOR BOATERS

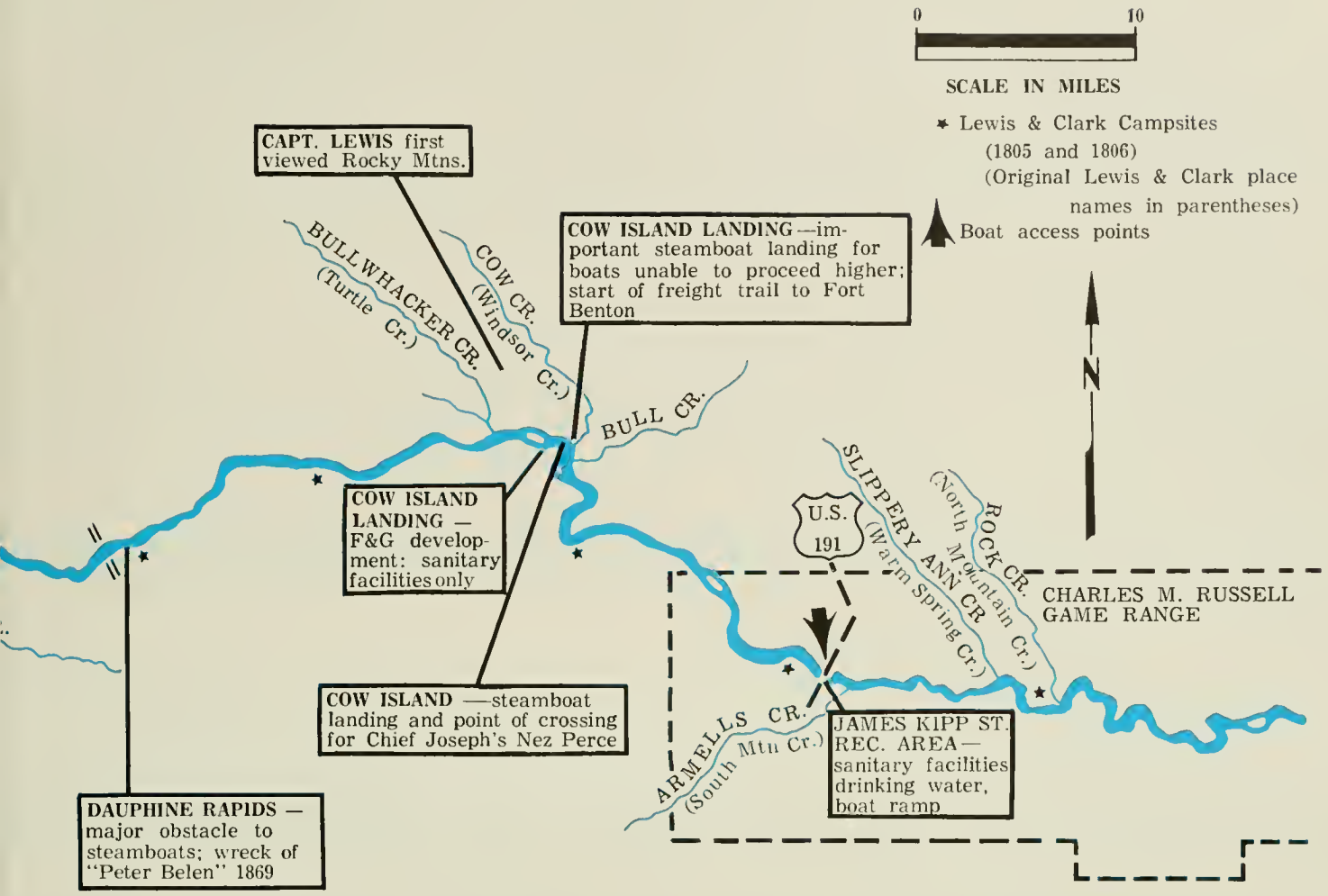
The Missouri will drift you along between three and four miles per hour. So, consider the distance you intend to cover and the speed of your craft. Don't forget to budget plenty of time for exploration and an occasional swim or siesta. The canoer can easily make 25-30 miles each day without undue exertion and can expect to cover the entire stretch from Fort Benton to James Kipp State Recreation Area in a week. If pressed for time, a shorter but still leisurely float from Coal Banks Landing to the ferry crossing at the Judith River is recommended. Two to three days will see you through this—the most scenic stretch. Whatever you decide, be sure to allow enough time for full enjoyment of the scenery, fishing, hiking, or other activities which strike your fancy.

CRAFT

In it's time, the Missouri has hosted a vast array of water craft from Indian "bull boats" to great steamers. Whether you choose a canoe or plush cruiser, make sure you are a competent operator and your equipment is in good repair. Remember the depth of the river varies seasonally, with June high water providing larger boats with the necessary clearance over sandbars and shoals. Shallow-draft motorboats and canoes can easily navigate the river through the entire summer with only an occasional encounter with the bottom when the main channel is missed. If you must use a motorboat, do take time to shut off the motor, sit back and enjoy the peaceful silence. Also, be sure to carry a supply of shear pins for outboards and perhaps an extra propeller. A few tools and an extra spark plug or two may also prove useful. An extra paddle or pole should be carried for getting clear of shore and sandbars. Remember also that you must stow away enough gas for the entire trip. Montana law requires that you have one Coast Guard-approved life preserver aboard for each occupant; children 12 years and under must wear a life preserver while in a moving boat. While any craft eventually will float you to the end of the trip, rubber rafts are not generally recommended. A slow current and strong upstream winds can be very frustrating.

PERSONAL GEAR

Personal gear will depend on the comforts you demand, but should include mosquito repellent, sunburn lotion, sunglasses, a wide brimmed hat and rain gear, along with standard camping equipment. Your footwear should include canvas tennis shoes which will get repeated dunkings while landing and launching, and sturdy hiking boots if you plan to explore on land. Gear should be stored in waterproof containers or bags (large plastic garbage sacks will suffice) as protection against rain showers, unless you are traveling in an enclosed boat. Food also is a matter of choice but must include fresh drinking water to last from one source to the next. Check the map to see where water is available. There is no practical way to replenish food supplies once you leave Fort Benton.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SCALE IN MILES
* Lewis & Clark Campsites (1805 and 1806) (Original Lewis & Clark place names in parentheses)
Boat access points
N
CAPT. LEWIS first viewed Rocky Mtns.
BULLWHACKER CR. (Turtle Cr.)
COW CR. (Windsor Cr.)
COW ISLAND LANDING—important steamboat landing for boats unable to proceed higher; start of freight trail to Fort Benton
BULL CR.
COW ISLAND LANDING — F&G development: sanitary facilities only
COW ISLAND —steamboat landing and point of crossing for Chief Joseph's Nez Perce
DAUPHINE RAPIDS — major obstacle to steamboats; wreck of "Peter Belen" 1869
U.S. 191
SLIPPERY ANN CR (Warm Spring Cr.)
ROCK CR. (North Mountain Cr.)
CHARLES M. RUSSELL GAME RANGE
ARMELLS CR. (South Mtn Cr.)
JAMES KIPP ST. REC. AREA— sanitary facilities drinking water, boat ramp

ACCESS

Presently, there are only five easy access points to the river between Fort Benton and the head of Fort Peck Reservoir. A glance at the map will show general locations. Fort Benton, on Highway 87, is the site farthest upstream and is a common starting point for floaters. Other possible embarkation points are the Loma Ferry 11 miles northeast of Fort Benton, off Highway 87; and the Virgelle Ferry about 12 miles downstream from Loma. Coal Banks Landing, site of a Fish and Game campsite and concrete boat ramp, is just downstream from Virgelle and is also a common starting point. (Follow the signs from the turnoff on Highway 87.) The next downstream access to the Missouri is at Judith Landing, site of another Fish and Game campground and crossing point for the Lohse-PN Ferry (named for a nearby ranch). Many floaters take out at this point, after an abbreviated trip through the scenic White Rocks Area. This crossing is 44 miles south of Big Sandy and about 40 miles below Coal Banks Landing. About 13 miles below Judith Landing, the river is crossed by Jensen Ferry, but access to this point is difficult, and most floaters choose to continue from the Judith on down to James Kipp State Recreation Area, the last practical point of access. James Kipp is located at the Fred Robinson Bridge on Highway 191; it includes a concrete boat ramp and camping facilities and marks the end of the trip for most Missouri floaters.

CAMPSITES

In addition to Coal Banks Landing, Judith Landing and James Kipp access points, Fish and Game has developed camps at three other sites. The map shows the general location and facilities provided.

Although Fish and Game encourages use of these public campgrounds, nightfall may catch you elsewhere. Good camp spots are abundant along the shore or on the numerous islands. Regardless of where you camp, respect the land. Be extremely careful with fires, and carry your garbage with you to the end of the trip.

PRECAUTIONS

The Missouri presents no special hazards to the floater, as long as some precautions are taken. You must be especially alert at ferry crossings and avoid a close approach to the upstream side of the ferry. Watch closely for cables strung across the river at these crossings and pass near shore where clearance is greatest. The rapids noted so prominently on some maps constitute no great hazard unless you are piloting a steamboat. Some provide an exhilarating run during periods of low water, but most are hardly noticeable. While on shore, it is wise to carry a stout stick and explore brush and grass in your path—there are rattlesnakes along the river. A first aid kit is advisable, but check with your physician before selecting a snakebite kit.

If you are not equipped for a do-it-yourself trip down the Missouri, commercial trips and boat rentals are available. For more information, contact:

Fort Benton Community Improvement Association; Fort Benton, MT 59442

Chamber of Commerce; Havre, MT 59501

Chamber of Commerce; Glasgow, MT 59230

Believe it or not, we have another controversy. . .

COMMERCIAL FISHING

by Jim Liebelt

EVERYBODY KNOWS MONTANA has some of the finest game fishing in the United States. Lakes, rivers and streams are renowned for catches of rainbow, cutthroat, Dolly Varden and brook trout. But not every one knows Montana has a thriving commercial fishing industry.

Commercial fishing isn't new to Montana. About 375 tons of carp were shipped from Nelson Reservoir to New York markets from 1923-1930. In 1931, 15 tons of carp were removed from Bowdoin Lake and shipped—live—in tank cars to New York and Philadelphia. Another attempt in the late 1920s involved commercial fishing for lake trout in Flathead Lake, but limited success and unpopularity with sport fishermen caused the venture to fail.

Additional commercial fishing wasn't evident until the 1950s. Since then, Lake Helena, the Missouri River, Medicine and Yellow Water Lakes and Fort Peck, Nelson, Canyon Ferry and War Horse Reservoirs have yielded from eight to nine million pounds of fish for commercial purposes. Fort Peck Reservoir has provided more than five million pounds of fish (the only source of continuous commercial fishing since 1957).

the controversy

Sport fishermen frequently object to commercial fishing, particularly in Fort Peck Reservoir, and insist that it impairs game fish populations. But many probably don't fully understand commercial fishing methods and regulations.

Since 1966, the Montana Department of Fish and Game has studied commercial fishing in Fort Peck Reservoir. Objectives are to monitor movements of commercial fish and gain knowledge of their life histories, obtain population estimates, gather information about harvest rates and examine commercial fishing methods and equipment. Thousands of smallmouth buffalo, river carpsucker and goldeye have been tagged in the last five years. Tagging shows that the smallmouth buffalo moves throughout the reservoir and that some spawn in successive years in the same area; tag returns show an overall 14 per cent harvest.

Fish and Game personnel initiated another tagging program—for channel catfish—in 1972 and are continuing it in 1973. Also, a selective method for taking commercial size goldeye was developed early in the study. Some areas of the reservoir are closed to commercial fishing and others restricted to certain types of gear. For example, to protect game fish, placement and mesh size of nets is specified. Each contract stipulates that game fish caught in commercial fishing gear must be released and their condition reported. Commercial fishermen must make a daily report on number or pounds of all fish taken. Contract violations can result in termination of the operator's license.

Fish and Game experiments with equipment similar to that used by commercial fishermen and observes commercial catches. These studies indicate the number of game fish caught is generally insignificant and not responsible for major decreases which occur naturally from time to time in game fish populations.

The decrease of northern pike in Fort Peck Reservoir, for example, is a direct result of poor spawning conditions due, in part, to reservoir management policies of the U.S. Corps of Engineers and near maximum reservoir levels for the past several years. If the water level is allowed to fall, shore line vegetation takes hold on exposed shores. When the water level rises slowly in the spring, the vegetation is covered and provides an unlimited spawning substrate for the pike. But, suitable shore line vegetation vital for successful reproduction of the species hasn't been established. Other species which depend on shore line vegetation for successful reproduction also suffer reduced populations.

actually improves sport fishing

What benefits come from commercial fishing? By removing large numbers of rough fish, less

COMMERCIAL FISHING continued

competition occurs between rough fish and game fish for food and space. This is especially significant during the early period of a fish's life because both game and rough fish then feed on similar organisms and inhabit much the same regions of water. Thus, by reducing rough fish populations, game fish have a better chance to survive and mature.

Removal of large numbers of carp is beneficial to a lake or reservoir since carp usually root out various food organisms on the bottom. Extensive bottom feeding causes deterioration of water quality and bottom conditions, both detrimental to growth of plant and animal life.

Commercial fishermen cooperate by providing information about concentrations of game fish which, in turn, aids in formulating fishing regulations. Knowledge of fish distribution in the reservoir and fish movement has been enlarged with help of commercial fishermen. In addition, commercial fishing adds to the economy by providing jobs and payment for goods and services, particularly at the local level. In 1970, 1971 and 1972, gross sales of Montana fish averaged about $100,000 per year. Approximately nine commercial fishermen regularly use Montana waters, although some fish in other states as well.

ten species fished

Ten species of fish from Montana waters are considered commercially valuable: smallmouth buffalo, bigmouth buffalo, carp, goldeye, channel catfish, black bullhead, river carpsucker, freshwater drum, common sucker and blue sucker. All except the carp and black bullhead are native to Montana.

Smallmouth buffalo and bigmouth buffalo are probably the most important commercial fish. These two species comprise about 75 per cent of the total commercial catch from Fort Peck Reservoir; during 1972, the harvest reached a record 237 tons. The only other body of water in Montana where buffalo are harvested commercially is Nelson Reservoir, which has produced about 40 tons since 1965. They provide excellent eating and sell for 89-98 cents per pound at retail markets. Most of Montana's buffalo are trucked to West Coast markets, particularly in the San Francisco area.

Carp are next in commercial importance. Since 1964, about 1,200 tons have been taken from Lake Helena and sold for a variety of commercial uses. Carp are also harvested from Fort Peck, Nelson and Canyon Ferry Reservoirs and Medicine Lake. However, they are not nearly as valuable as the smallmouth and bigmouth buffalo, but are used extensively as food by certain ethnic groups such as Blacks and Orientals in large cities. Many carp are sold in Jewish communities, especially for holidays. In addition to selling them raw, carp are smoked or ground up and made into fish balls. Also, before pelleted dried feed replaced it, ground carp nourished trout on some fish farms.

Another heavily used commercial fish in Fort Peck and Nelson Reservoirs is the goldeye. Since 1966, Fort Peck has yielded 313 tons and Nelson, 25 tons of marketable goldeye. However, catches in Fort Peck have declined steadily in the past several years and Nelson produces only a fraction of its former harvest. A quota was imposed on goldeye in Nelson in 1971 and regulation in Fort Peck may also be necessary to protect and maintain a fishable goldeye population for the future. Although Montana sport fishermen regard the goldeye with disdain, it is considered a gourmet's treat in Canada and sells in restaurants at steak dinner prices. Goldeye were abundant in Canadian waters, but because of very intensive commercial use, most accessible stocks were overfished. Now the Canadian market relies almost entirely on fish from the United States, and much of Montana's goldeye is trucked to Winnipeg, Manitoba, to be smoked and sold.

Harvest of channel catfish in Montana since 1957 totals about 65 tons; all have been taken from Fort Peck Reservoir, the only body of water in Montana with sufficient population to support commercial efforts. Fishing for black bullheads in Yellow Water Lake and War Horse Reservoir has yielded only a few tons. Channel catfish and black bullheads are quite valuable, since they retail for about $1 per pound. As table fare, they rank among the most popular fresh-water fishes in the United States.

The remaining commercial species—river carpsucker, freshwater drum, common sucker and blue sucker—represent a very small part of the total harvest from Montana waters. Many river carpsucker and freshwater drum exist in Fort Peck Reservoir, but they are not extensively fished due to a low market value compared with buffalo or goldeye. About 26 tons of suckers have been harvested from Lake Helena since 1964, while Fort Peck and Nelson Reservoirs have produced about 1.5 tons each. Like the river carpsucker, their flesh has excellent flavor, but contains many small bones making it difficult to eat.

the methods

Commercial fishermen use a variety of meth-

ABOUT THE AUTHOR

Dr. James E. Liebelt is project leader for the Fort Peck Reservoir commercial fisheries study being conducted by the Montana Department of Fish and Game. In 1960, he received a B.A. in biology from Concordia College, Moorhead, Minnesota. His M.A. and Ph.D, both in zoology from Montana State University, Bozeman, were granted in 1968 and 1970 respectively.

ods and equipment to harvest fish. They must be familiar with habits of the species for which they are fishing and use selective gear, if they are going to be successful. Each species has seasonal habitat requirements and behavioral patterns related to food supply, reproduction, age and physiological condition. Also physical and chemical factors affect water and influence fish behavior.

Baited hoop nets—which are set on the bottom in moving water near the head of Fort Peck Reservoir—are most effective in taking channel catfish as they move upriver in spring and downstream (to the reservoir) in late summer. Floating gill nets, set overnight, are used to catch goldeye which feed near the surface after dark, with the best catches occurring during spring and fall. Trammel nets, placed on the bottom, are used primarily for smallmouth buffalo, bigmouth buffalo and river carpsucker, although other bottom feeding species such as freshwater drum and carp are often caught. Large seines are used to take smallmouth and bigmouth buffalo in Fort Peck Reservoir and carp and suckers in Lake Helena. One commercial fishing company plans to use a 3,000- by 30-foot seine in Fort Peck Reservoir this year.

What is the future of commercial fishing in Montana? Probably it will never be a major industry. With proper management of commercial fish stocks and protection of Montana waters from further degradation and pollution, commercial fishing should continue to gain in importance. Fort Peck Reservoir will remain the center of commercial fishing, unless the upstream Missouri River is degraded by more dams, channelization for barge traffic or alteration for large scale water diversion programs.

One thing is certain: if predictions about the world's population doubling within the next 20 years are accurate and the anticipated shortage of food occurs, fresh-water fish will play an increasingly important role as a source of food for mankind.

wildlife shorts

Great horned owls lay round eggs. All other owls have oval eggs.

* * *

Arctic mammals have a fat in their feet that remains soft during sub-zero temperatures. Locomotion would be very difficult without it.

* * *

Bobwhite quail populations undergo an annual 75 to 80 per cent mortality rate whether or not the bird is hunted.

* * *

Woodpeckers can stretch their tongues twice the length of their bills when searching for food.

More than one-half of the endangered wildlife species in the United States are found in the State of Hawaii.

* * *

The web spun by that lowly arachnid, black widow spider, has some special qualities that make it ideal for the crosshairs for telescopic sights.

* * *

Mountain lions keep their kittens with them for two years to teach them the skills of hunting and stalking.

* * *

Spiders can determine exactly what kind of prey have been trapped in their webs from the vibrations caused by the victim's struggles.

Indian lore has it that the coyote will be the last animal on earth.

* * *

"Hand acid" (natural oils from the skin) on a lure may be repulsive to fish. This may indicate why one fisherman catches more fish than another man with the same lure.

* * *

The only mammal that does not have even the vestige of a tooth anywhere in its development is the spiny anteater of Australia.

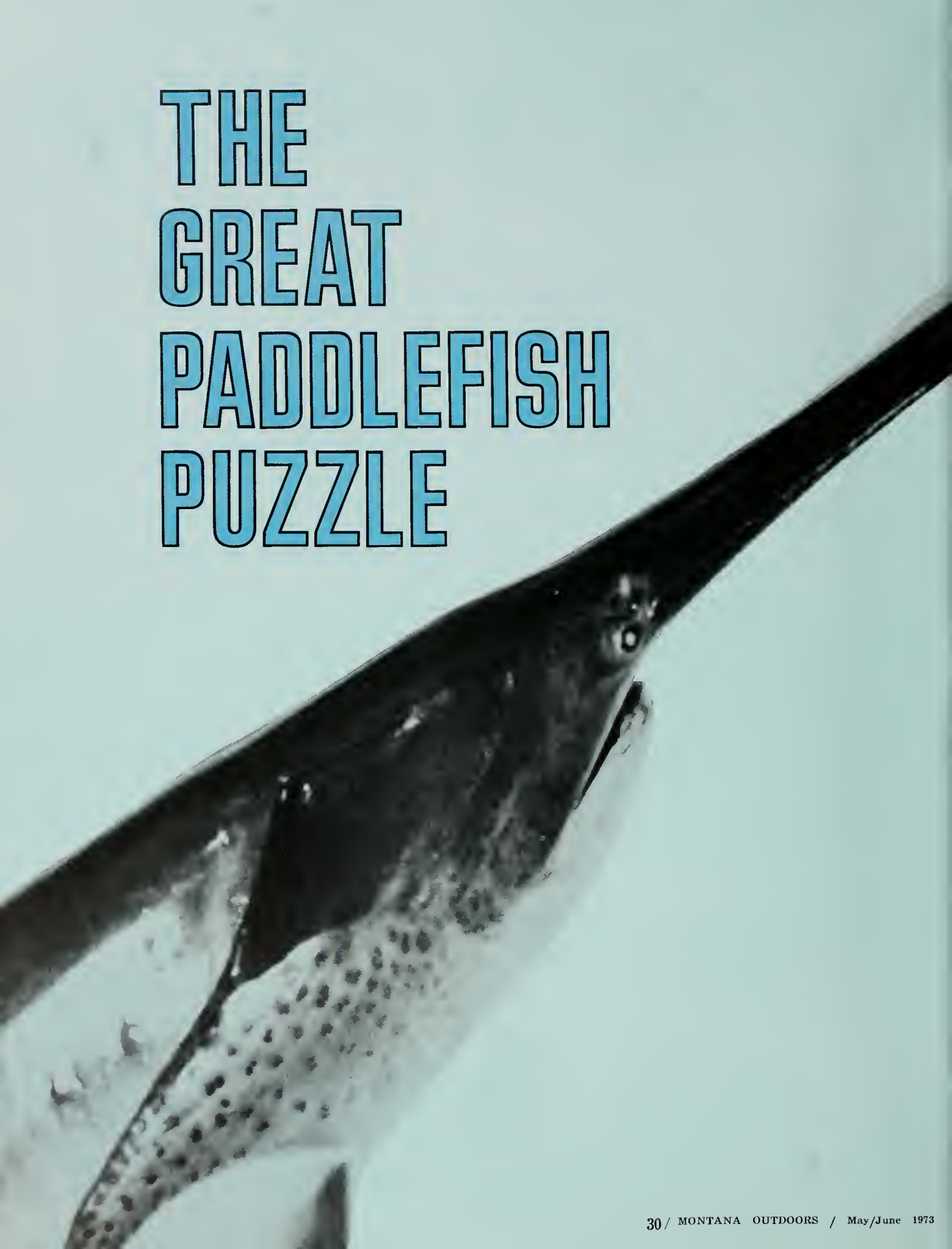
* * *

Common or "Norway" rats cause about $200,000,000 in property damage annually.

* * *

Only about one-third of all cottontail rabbits live long enough to leave the nest.

THE GREAT PADDLEFISH PUZZLE



BY AL ELSER

THE YELLOWSTONE RIVER offers a wide variety of fishing, as it flows out of Yellowstone Park and winds its way through Montana. Fishing in the free-flowing headwaters produces fine catches of Yellowstone Cutthroat trout. "Blue Ribbon Trout Water" from Gardiner to Big Timber attracts fishermen from all over the country to the Yellowstone. Rainbow and brown trout reign supreme with a number of tackle-busting lunkers caught each year.

By the time the river reaches Billings, it is an ecologically different stream than when it left Yellowstone Park. Decreased water quality and increased water temperature produce a transition from trout to warm water species such as sauger, channel catfish and burbot.

Another facet of angling on the Yellowstone can be experienced in the river's lower reaches, near Glendive. Each spring some 3,000 fishermen flock to Intake, site of a low diversion dam, and "beat the water to a froth" in pursuit of the senior citizen of the Yellowstone—the paddlefish.

paddlefish anatomy

Paddlefish skin is smooth and scaleless, except for the upper lobe of the tail, where a trace of primitive rhomboid (diamond-shaped) scales are found. Its skeleton is cartilaginous and it has a notochord (forerunner of the central nervous system). Jaws of young paddlefish are finely toothed, but the teeth are lost by adulthood.

The most striking anatomical feature of the fish is its long, paddle-shaped snout. The paddle, the top and sides of the head and the long, pointed operculum flaps (gill covers) are covered with sensory pits, giving these areas the appearance of pigskin leather.

Contrary to popular belief, the snout is not used for rooting or digging up bottom organisms for food. Paddlefish feed on plankton (microscopic plants and animals) and use their enlarged sense organ (their paddle) to locate food. Their gill arches carry long, fine gill rakers to filter out plankton as large quantities of water pass through the enormous mouth and out the gills.

unusual fishing rigs

Since these giant relics are "vegetarians," and don't eat minnows, worms or any other traditional fish bait, fishing rigs are likewise untraditional. Because of its picky table manners, the only successful method of catching paddlefish is by snagging. The rod and reel used must be heavy-duty and the line must be strong enough to withstand the pull of a 70-pound fish. No paddlefishing outfit is complete without one or two large treble hooks and a heavy sinker. Many anglers use discarded spark plugs for weights. The "business" portion of the gear is cast upstream, allowed to sink and retrieved with a jerking motion. When the hooks sink into one of those monsters, look out!

Paddlefish also inhabit the upper half of Fort Peck Reservoir and they run into the Missouri River during spring. Snaggers concentrate along

...still has a few missing pieces.

several areas below the Fred Robinson bridge. The largest paddler taken in Montana, weighing 131 pounds, was snagged here; average size is from 50 to 60 pounds.

Although the paddlefish (*Polyodon spathula*) is a recent addition to Montana's list of game fish—it was added in 1965—it survives from an ancient and primitive group. Fossil remains reveal that paddlers have lived in Montana for about 60 million years. Their only remaining relative is the giant *Psephurus* which inhabits the Yangtze River in China. This relative supposedly reaches lengths of 20 feet. It possesses a more conically shaped paddle and relies more on bottom feeding than the North American variety.

paddlefish history

Hernando De Soto, a 16th century explorer and the first white man to cross the Mississippi River, was the first to note the existence of the paddlefish. De Soto's log describes the "pele-fish" as having no scales with the upper jaw resembling a "pele" or "spatula." Thomas Jefferson mentioned the paddlefish when he listed fishes of the Mississippi River. An August 26, 1864, excerpt from the diary of James B. Atkinson, a soldier on the Scully Expedition, states, "Some of the soldiers shot fish in the river, bagging some spoon fish six feet long." The Indian fighters were on the march from Fort Union—near the confluence of the Yellowstone and Missouri Rivers—to Fort Rice, North Dakota.

Although presence of paddlefish had been documented in the Yellowstone River in the early 1900s, interest increased in 1962 when a Glendive resident snagged a weird looking fish. Its identity puzzled local anglers. It was thought to be a freak catch, but within a week, more than 60 additional paddlefish were snagged. Where did they come from? Why? Why did these relics suddenly reappear after so many years? Where were they going? A study to answer specific questions about paddlefish movements, life history and harvest was initiated by the Montana Department of Fish and Game in 1963; the study is being expanded this year.

movements traced

A part of the study was to trace movements of a large number of paddlefish. To effectively follow movements within a fish population, individuals must be marked so they can be easily recognized. In this study, numbered plastic poultry bands were used to tag paddlers caught at Intake. The tag was placed in the lower jaw of the fish after information about length and weight had been recorded.

Since 1963, 2,459 paddlefish have been tagged and released at Intake. Anglers have taken and reported about 10 per cent of them. The majority of those recaptured were taken in the same area where they were tagged, but 21 fish tagged at Intake were caught in other areas. Eleven tagged fish were recaptured in Garrison Reservoir, approximately two hundred miles downstream in North Dakota. Tagged fish have also been caught near Terry, at the mouth of the Tongue River, at Forsyth and in the dredge cuts below Fort Peck Dam on the Missouri River.

Return patterns of tagged fish helped solve part of the puzzle. Garrison Reservoir is apparently the source of fish caught in the Yellowstone. Research in other areas revealed that paddlefish migrate upstream in the spring to spawn. Change in water temperature and an increase in water level triggers the paddlefish movement out of Garrison Reservoir into the Missouri. Since fish tagged at Intake were caught a few years later below Fort Peck, a portion of the population apparently

Because the paddlefish (left) feeds only on microscopic aquatic organisms, traditional fishing methods are useless. So, rising to the challenge, today's angler has devised a very productive fishing method—snagging. The typical gear (right) includes several large treble hooks and heavy weights . . . used spark plugs, in this case.

continues up the Missouri while others move into the Yellowstone. Tagged fish taken at Forsyth have moved at least 150 miles upstream from Intake in search of spawning areas.

Additional tag returns support this theory. A fish tagged in the Van Hook Arm of Garrison Reservoir in 1966 was caught at Intake in 1971. Also in 1971, two fish tagged in the Fort Peck dredge cuts were taken at Intake, with three more caught in 1972. The fact that fish tagged at Intake have been caught in the Missouri River below Fort Peck and fish tagged in the dredge cuts have returned to Intake suggests that paddlefish are not as selective as salmon in choosing spawning streams.

age determined

With the "where" part of the puzzle locked into place, the "why" piece was also picked up. To solve this part of the puzzle, ages of fish being caught were studied. Paddlefish have annual growth rings in their cartilage, similar to growth rings in a tree. In 1964-65, lower jaws from a number of paddlers were collected. A small cross section of each jaw was magnified and growth rings counted. Ages of the fish ranged from 4 to 25 years and 88 per cent of the fish were from 7 to 12 years old. Other studies have shown that paddlefish are not sexually mature until they are quite old (males from 7 to 8 years, and females from 12 to 14 years).

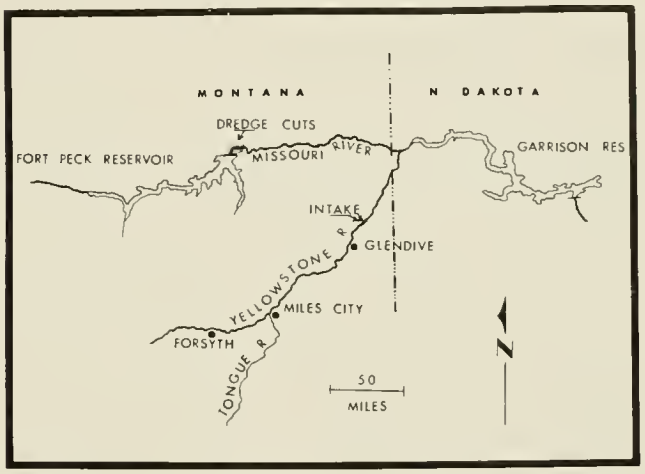
The history of Garrison Reservoir sheds additional light on this part of the puzzle. When the dam was completed in 1953, the reservoir began to fill. When new reservoirs are filling, they provide exceptionally large amounts of plankton. As this large impoundment filled, it provided ideal habitat for survival of young paddlefish. Filling of Garrison Reservoir and formation of this large group of from 7- to 12-year-old paddlefish correspond exactly. The young paddlefish trapped in the new reservoir survived, grew and once again ran up the Missouri and Yellowstone Rivers to spawn. This created the excellent fishing for paddlers which now exists at Intake.

Creel census information over the years reveals that fish caught at Intake have increased in size. In 1964, anglers creeled about 28 tons of paddlefish; individual fish averaged about 22 pounds. Fishermen in 1972 took home about 21 tons of fish with an average individual weight of 34 pounds. During the early years of the fishery, a paddler weighing 40 pounds was considered a trophy. Now, fish from 60 to 70 pounds are not uncommon and the largest taken at Intake in 1972 weighed 78 pounds.

As the puzzle started to fit together, another question developed. Between 1963 and 1969, less than three per cent of the fish examined at Intake were female, suggesting the main spawning activity was occurring somewhere downstream. In 1970, females increased to 11 per cent of the fish examined; in 1971 and 1972, females made up nearly half of the paddlers caught. The increase in females indicates the population now is reaching maturity. Maturation of females also corresponds with the impounding of Garrison Reservoir. Since the females are older and correspondingly larger than the males, the increase in larger fish can be attributed to the females entering the run in 1970. Two more pieces of the puzzle fit into place.

spawning a mystery

One important part of the puzzle remains unsolved: Where do the paddlefish spawn and with what success? Occasionally, a small paddler (from 8 to 10 pounds) is taken, which indicates the population is reproducing. According to observations in Missouri, paddlefish spawn over large gravel bars when water levels rise in the spring. The eggs are scattered rather than laid in a redd or nest. They become sticky after fertilization, clinging to rocks and debris. Favorable locations for incubation and hatching are well aerated gravel bars, swept clean of silt. Incubation takes from 10 to 12 days. When hatched, small paddlefish do not have the paddle and only slightly resemble their parents. However, development is rapid and by the third week, they show characteristics of adult fish.



The paddlefish study is being expanded to try and locate spawning areas used by paddlefish in the Yellowstone River. Hopefully, this will put the last piece of the puzzle into place. In the last decade, miniaturized batteries and transistors have made the science of biotelemetry possible. (Biotelemetry is the technique of gathering data about a living organism and its environment by following signals from a miniature transmitter attached to the organism.) Telemetry units implanted in paddlefish caught at Intake will enable tracking by use of aircraft. Jet boats will aid in more specific tracking assignments. If spawning areas can be located, specific questions concerning the physical require-

ments for spawning success hopefully can be answered.

coal threatens paddlefish

The future for paddlefish in the Yellowstone River may depend on these answers. The habitat must be identified and preserved for this unique fish to continue contributing to the recreation potential of the Yellowstone. Coal development in southeastern Montana threatens to alter the normal flow of the river. Development of resources at mine sites for generation of electric power and manufacture of synthetic gas or liquid fuels will require diverting water from the Yellowstone and conveying it to the power plants. Water needs at these sites are projected as high as 2.6 million acre feet of water annually. Keeping this water for industrial use will mean offstream storage and diversion structures which will alter the present flow of the river. Industrial control would probably result in a uniform flow pattern, rather than a cycle of peak discharge in the spring and low flows in late summer and fall. Since the paddlefish spawning run is triggered in part by peak flows in the spring, a reduction in flow at this crucial time could possibly eliminate the paddlefish in the Yellowstone.

Paddlefish once were numerous in the Mississippi drainage, which touches 31 separate states. Initially, fishermen took paddlefish only for their eggs, but the flesh soon attracted attention, resulting in a sudden rise in the commercial harvest around the turn of the century. Commercial exploitation rapidly affected the paddlefish, with commercial catches declining sharply in the first decade of this century. Construction of dams limited migratory movements of the paddlefish and resulted in further population decreases.

Although paddlers are abundant in some areas, the U.S. Fish and Wildlife Service lists only seven known spawning areas—of which the Yellowstone River is one. Discharge of industrial effluents into Midwestern rivers took its toll. Pesticides found in high concentrations in adults, eggs and fry undoubtedly further inhibited spawning.

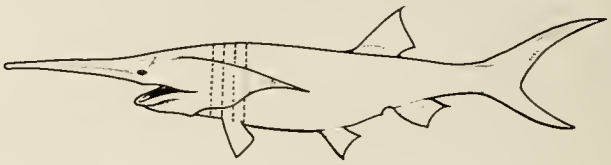
In short, the paddlefish is on the brink of becoming rare, if not endangered. Let's hope this senior citizen's millions of years in Montana will not end with the 20th century.

ABOUT THE AUTHOR

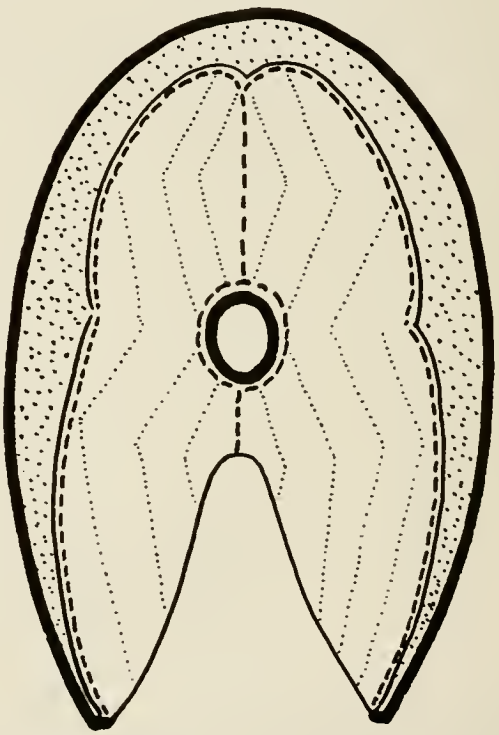
Al Elser is regional fish manager for the Montana Department of Fish and Game in Miles City. Elser, 34, was granted a B.S. in fisheries science from Colorado State University, Fort Collins, in 1964. In 1967 he received a M.S. in fish and wildlife management from Montana State University, Bozeman.

HOW TO CLEAN A PADDLEFISH

Paddlefish are not only exciting to catch, but if cleaned properly, delicious to eat.



First, remove the notochord by cutting around the narrow part of the tail to the soft cord, and then pull the tail and cord away as one unit; remove the head and entrails. Next, slice the body crossways into one- or two-inch steaks.



Lay each steak down flat and trim (along dotted line as shown in above drawing) the skin and outer red or darkest meat away from the inner or light colored meat. It is very important to remove all of the dark meat prior to cooking. The flesh is now ready for smoking, frying, deep-frying, broiling or any other method used to prepare fish.

dear F&G

POLICY ON LETTERS

Letters published in the "dear F&G" section of MONTANA OUTDOORS do not necessarily reflect the opinions and philosophies of the Montana Department of Fish and Game. They represent the author's feelings. We reserve the right to edit letters according to space limitations.

ospreys, cherry growers and pesticides

We are writing on behalf of the Skidoo Packers—a two-year-old Montana corporation on Finley Point of Flathead Lake. We pack and ship the superior Flathead cherries throughout the country every year in late July and early August. Several of our large grower/members are attempting to employ orchard practices that will eventually eliminate use of chemical fertilizers and pesticides, but until the American people acquire a taste for little white worms in their cherries, we continue to use, when the fruit fly emerges, the least toxic but effective pesticides. We think of fish and birds with our selection of pesticides but, foremostly, of *man*.

Too many would-be ecologists make claim to being wise mentors who can see the faults of we "rapers of the land," as if we blatantly raise our crops with only thought of profit and to heck with the osprey and fish and other living things. How much more would be accomplished if these "specialists" would not look down at us but educate us if we truly are ignorant, rather than creating animosity by printing untruthful words which appear to us to malign the entire cherry industry of the Flathead.

If the desired effect was to anger us, you succeeded. We refer to the article in your March/April 1973 edition, entitled "Final Call for Montana's Finest Fisherman?", by Doug and Don MacCarter. The authors state that the "cherry growers frequently apply Cherry Fruit Fly 'Dust,' a harmless chemical, but some use hard pesticides as well. In addition, the entire Flathead Valley is sprayed to control gnats."

Now, their research must be based on interviews—hearsay, at best, because DDT hasn't been used in orchards for 25 years. In this area we are not aware of spraying for gnats. "But some use hard pesticides as well . . ." Shouldn't this spicy bit of information be material for another article such as "Final Call for Montana's Finest Men?" The local county agricultural extension office recommends the use of Parathion. Apparently they, like the Department of Fish and Game, value the osprey more than man. We might suppose that Parathion would be considered a "hard" pesticide since a little absorbed by the skin is lethal, yet it is not a chlorinated hydrocarbon and wouldn't interfere with carbonic anhydrase activity.

By "hard" pesticides, you must mean one with a long half-life, such as DDT. None of the growers use chlorinated hydrocarbons which the authors say cause problems with the osprey. The paragraph we quote does not state that the cherry growers use DDT but the implication is strong—supported on the last page with a picture of some "peewee" pollinizer cherries (not at all representative of Flathead cherries) with a caption stating that the types of chemicals we cherry growers use "may mean taps for Montana's expert angler." It is here, Mr. Editor, that we implicate you. You apparently approved this unfounded article and contributed your own *coup de grace* with the addition of the picture and caption.

We agree with the authors that, "Extensive studies of inlet streams and the lake are needed to pinpoint the source and site of contamination." We would add that since DDT is stored in the females' fat and is fed back into her circulation anytime she is metabolizing fat, her wintering environment should be checked out also. We also knew of widespread use in the past of DDT by the forest department.

We too speak the language of the authors since among us are a biology teacher and a public health doctor. For goodness sake let us all join the elite group of ecologists by sharing our problems and our goals. You can set the record straight by getting firsthand information on the use of DDT around Flathead Lake and presenting our letter or an apology in your magazine.

Stanley Thurston, Jr., President
Skidoo Packers
Polson, MT

A GREAT MAGAZINE

I wish to commend you and the department for your excellent MONTANA OUTDOORS. The articles are fine and the photos outstanding.

I particularly appreciate the educational nature of the articles and the series on Montana Coal is most timely and urgent. I also like the recycled paper and the different colors on certain pages which is both attractive and useful in calling attention to specific features.

I am puzzled by the letter from James R. Duke in the March/April issue suggesting that MONTANA OUTDOORS is an inferior product. I am somewhat familiar with similar publications in all 50 states and am proud of MONTANA OUTDOORS.

Keep up the good work!

Cecil E. Gubser
Billings, MT

MAKING FANS OUT OF CRITICS

At our meeting February 6, a motion was unanimously passed to commend the Fish and Game Department for the fine job they were doing on MONTANA OUTDOORS. I have heard many favorable comments regarding the magazine and I feel sure that your circulation will increase in this area.

Passage of the motion was very pleasing to me, because about a year ago the club voted to question the department about the advisability of publishing a more expensive magazine. The quality of the magazine has evidently done the job of turning critics into boosters.

H. W. Black, Secretary
Polson Outdoors, Inc.
Polson, MT

AN ANSWER TO THE SUN RIVER SITUATION

As a professional mammalian ecologist, I was interested in the article by Dr. Harold Picton in the January/February issue on the elk problem in the Sun River Game Preserve. With overpopulation, the range is deteriorating and elk are starving. Animals are being wasted, those that survive are in very poor condition.

(Continued on Page 38)

recycled paper

CLASSROOM CONSERVATION

BASIC CONSERVATION FOR THE YOUNG CONSERVATIONIST

WATER AND WILDLIFE

ALMOST AS LONG as man has used water, he has abused it. The almost total lack of pollution control during the past century has resulted in many polluted streams and lakes—water no longer fit to drink or to bathe in or for fish.

Because of poor land management, some stream bottoms are choked with silt, destroying their value for fish by covering up necessary food supplies and spawning areas.

While water quality declines, demand for water constantly increases. The water we drink usually comes from the best and least polluted source. It is then treated to make sure it's safe for drinking. But today there is so much pollution, it gets more and more difficult to find good, clean water.

Of all the uses for water, fish and wildlife are one of the most fragile. Man can adapt to changes in water quality with artificial treatments. However, fish and other aquatic life are more sensitive to pollution and often end up helpless victims of man's carelessness.

Pollution poses many problems, but one of the most serious for fish is a lack of oxygen. Water without oxygen kills fish as quickly as air without oxygen kills humans.

Sewage sometimes robs up to one-half of the oxygen in a lake or stream. It does this by being used up as the organic matter in sewage is broken down. The amount of dissolved oxygen declines, suffocating the fish.

But sewage from people isn't the only cause

HOW MUCH DO YOU KNOW ABOUT WATER?

In the following quiz, match the correct definition in column two with the words listed in column one.

1. Watershed	a. Water power transformed into electric power
2. Aqueduct	b. Science developed around physical, chemical and biological changes that take place in lakes and reservoirs
3. Reservoir	c. Regions of great value to wildlife that are covered permanently or for long periods of time with shallow waters
4. Water Table	d. A region draining into a small stream, river, river system or lake or other body of water
5. Evaporation	e. The surface in a permeable body of rock of a zone saturated with water
6. Ground Water	f. Water that flows under the soil into a stream
7. Irrigation	g. An artifical channel or pipe designed to transport water from one source to another
8. Run-off	h. A body of water trapped behind an artifical, man-made structure
9. Transpiration	i. After evaporation, the remaining water in plants is absorbed by plant roots. It travels up the stems and evaporates into the air through pores in the leaves
10. Desalination	j. To convert or change into vapor
11. Hydroelectric power	k. Using water for crops and/or livestock
12. Wetlands	l. Conversion of salt water to fresh water
13. Limnology	m. Water that flows over the surface of the land in sheets or streams, often causing erosion.
14. Pollution	n. Artifical deposition of sand, gravel or other material on the submerged land or low shore line of a lake
15. Sediments	o. The addition to the water or shores of a body of water, any material which endangers human health or destroys or adversely affects aquatic life or recreation

(answers on page 38)

recycled paper

of water pollution. A great deal comes from industrial plants located near sources of water. These plants locate near water because the manufacturing usually requires lots of water. When industry disposes of its waste materials, money is often saved by dumping by-products into the nearest river or stream.

Fertilizers and pesticides sometimes run off from crop lands and add to water pollution problems. Excessive land clearing and grazing causes silt to flow into streams and water quality deteriorates. Building large dams and diverting water through canals can also lower a stream's capability to support fish.

Where water quality has deteriorated, and this includes rising water temperatures, those fish species most susceptible become less likely to survive. They are often replaced by species more tolerant of reduced water quality (e.g. carp, suckers and other rough fish). Therefore, the quality of the fish population also declines as the water quality declines.

classroom action on water pollution

Debating is a good way to learn to express yourself. Our topic this issue is water pollution. Divide the class in half and debate this issue, "Is a small amount of pollution okay?" Remember, a good debater is one who can argue for the opposition as well as argue for his own topic.

Many lakes formerly full of trout and other game fish, now have only carp—a species that can tolerate a lower oxygen content in water.

Although pollution may not kill fish outright, lower water quality can affect them in other ways. Fish subjected to reduced water quality grow at a slower rate, are more susceptible to disease and have more trouble coping with changes in their environment.

Probably one of the most ominous threats facing some of Montana's fishing waters is coal development. The proposed industrial complex in southeastern Montana could pollute, dry up or heat streams which now produce fish and good fishing.

Much is being done to clean up Montana streams that formerly were degraded by water pollution. Such a stream is the Yellowstone River. Due to efforts by industry and municipalities, a general improvement can be noted. Even as this river recovers, all could still be lost due to dewatering through excessive withdrawals to supply coal field demands. This story unfortunately is typical of the problems all natural communities face as man places increasing demands on the resources of earth.

Why should you worry about keeping healthy fish populations in Montana's lakes and streams? Because, if fish can thrive, then the water is pure and fit for humans. But if fish can't survive, it means that your environment is also polluted, not just the fish's.—*Toni Jensen*

ENVIRONMENTAL POLLUTION IN MONTANA, edited by Robert Bigart, Mountain Press Publishing Co., Missoula, MT, 261 pages, paperback, $5.95.

This collection of papers, some previously published, is an effort to give the layman information for making environmental decisions. Readers without background in the sciences will have difficulty with some of the papers. Quality of the papers is uneven, despite the impressive credentials of most of the authors. At least two of the titles offer much and give little, but, on the other hand, some articles are excellent.

The introductory section documents the history of air pollution in Butte and relates economics to pollution control. Several articles describing air pollution in various localities follow. The section on water pollution, containing only four papers, emphasizes laws and especially discusses pollution of the Clark Fork of the Columbia. The article, by Dr. George Weisel of the University of Montana, is especially well done.

A section labeled "special problems" contains two papers on pesticides (with the authors reaching radically different conclusions), one on solid waste management and one on coal strip mining.

Although political opinions pervade several articles, a special section is set aside for political and philosophical aspects of environmental management.

The paper about the Montana Chamber of Commerce position on 1971 environmental legislation would hardly be missed, but Dr. C. C. "Clancy" Gordon's article, "The Conscience of a Conservation-Scientist," deserves considerable thought.

Tables and figures are, for the most part, easily understandable. The various professional affiliations of the authors give a wide range of viewpoints. In spite of its weaknesses, most Montanans would benefit from reading this book.—*Phillip Stewart*

OUTDOOR SURVIVAL, distributed jointly by The Avalon Hill Co., Baltimore, and Stackpole Books, Harrisburg, PA, 1972, no price listed.

Outdoor Survival is not a book. It's a game—an adult game about wilderness skills.

If you're one of those who likes to completely involve himself in something and forget about everything else,, then you'll probably go for *Outdoor Survival*. It takes a good hour or so just to figure out exactly what's happening, but after that, the game turns into a challenge that can tax most minds.

In a nutshell, the game is a race to get through the great American wilderness — deserts, forests, mountains and swamps without, as the game makers put it, letting your "life index" get too low.

The game includes a primer on wilderness skills which does have some usable information on direction finding, obtaining water, building a fire, etc.

If you're tired of books, try a game. But don't buy it unless you like to sit down for several hours and completely absorb yourself in it. It's fun, but time consuming.—*Bill Schneider*

recycled paper

(Continued from Page 35)

and the carrying capacity of the range is rapidly decreasing.

Opening the area to hunting was suggested as a remedy. This is certainly a logical suggestion. I am not opposed to hunting and tend to look with favor on the suggestion.

However, there is an alternative which I think should be considered. Native species like elk are ordinarily controlled by native predators and other natural factors. There are mountain lions in Montana and apparently now a few wolves. Since there is plenty of good hunting for everyone in Montana outside this preserve, it is not needed for hunting. A natural ecosystem involving elk and large predators would be a unique asset to Montana, as yours is one of the few states large enough to afford it. I wonder if Dr. Picton would care to comment on the status of mountain lions and wolves in the preserve and the prospect of attaining a balance by this means.

Predation has an advantage over hunting because predators tend to remove more of the diseased and injured rather than the trophy animals and thus keep the herd in top condition. It is good to have such a herd available to provide high quality stock to reestablish elk in other parts of their former range.

Wayne H. Davis, Ph.D.
Professor
University of Kentucky
Lexington, KY

● *The management program for the Sun River Game Preserve is a product of the actions of many individuals which makes it difficult to pin down specific decisions and the reasons for them. Some 20 management ecologists have worked there over the years. I do not have a decision-making role concerning the preserve and have only acted as a chronicler of events.*

The Sun River Game Preserve is not a self-contained ecological unit. It forms only part of the home range of the elk residing within it. Attempts to harvest this group of elk when they move out of the preserve has created undesirable hunting (firing line) conditions along the preserve boundary and elsewhere across migration routes. Harvest attempts have resulted in overharvest of elk residing outside the preserve, while not getting at those in the preserve. The political activities of several sportsmen's clubs in the area have also prevented quick manipulation of hunting seasons needed to harvest preserve elk.

The preserve contains very little winter range. However, elk use this range heavily in the spring and fall with relatively small numbers using it through the winter. The range has been heavily abused in the past and it is heading in that direction once again.

Predators found in the area are coyotes, mountain lions, black bear and grizzly bears. There are no wolf packs in the area, although a few wolves have been observed. The Sun River area is connected by wilderness to occupied wolf habitat in Canada. Thus there are no obvious barriers preventing movement of wolves into the Sun River. No significant predator control has been carried on in the mountain portions of the drainage for more than 30 years and it is likely that the predator populations have reached equilibrium. Both deer and elk populations increased in the Idaho Primitive Area, in spite of mountain lion predation. Grizzly bears are regarded as relatively ineffective predators of elk. (I'd be pleased to provide appropriate references.)

The bighorn sheep in the Sun River form one of the major herds in North America. Its size is dependent on keeping the size of the game preserve and non-game preserve elk populations under tight control.

It should be noted that what I call unmodified wilderness wildlife management is carried on in both Glacier and Yellowstone National Parks. Other areas of the state also approach it. Available elk habitat in the northern Rockies is saturated and it has been difficult to find recipients for elk trapped in the Yellowstone Park area.

The argument concerning the preserve is really a question of whether it should be under legislative control or under the Fish and Game Commission like the remainder of the state.

The Sun River bill I mentioned in the article was tabled by the Montana legislature until next year.

Harold D. Picton, Ph.D.
Associate Professor, Zoology
Montana State University
Bozeman, MT

QUIZ ANSWERS

1-d	6-f	11-a
2-g	7-k	12-c
3-h	8-m	13-b
4-e	9-i	14-o
5-j	10-l	15-n

MISCONCEIVED ATTITUDES

I especially appreciate your articles concerning Montana's natural magnificence and that tendency of inadequate man to improve upon it.

Being from Eastern Montana and from a family deeply concerned with the present and future problems that this state has to deal with, I feel that I have developed a sensitivity to the natural heritage of Montana. To those who would strip Montana of its glory just to nurse a greedy propensity, I simply must mutter a word of uncomprehension.

To those wishing to construct a concrete and asphalt border disrupting the unity and splendor of the Absaroka and Beartooth Wilderness Areas, I must ask, why? Surely these people do not know the grandeur and worth of a land virtually untouched by the malignancy that is suffocating our lands today. Surely they have not experienced the awesome power and omnipotence of the almighty Father that seems so prevalent in these extraordinary creations. To be there in the midst of all this glory, whether it be the rugged buttes or the rolling prairies, or the towering peaks or breath-taking canyons is to witness the infallibility of God. Man has yet to even imagine a creation of greater genius. Those glutinous people who stare with their voracious eyes at the immense wealth of my state, but see only that which promises to make them rich, show a perverted sense of priorities.

To change priorities is an ever elusive goal for those of us who realize where true wealth lies. But we must keep on trying.

I sincerely hope that I have offended only those people who have expressed the misconceived attitudes that prompted this letter.

Greg Cross
Billings, MT

WHO CARES ABOUT THE PAPER?

Mr. Duke's letter in the March/April issue seems grossly selfish and unfair. Instead of criticizing the paper quality, Mr. Duke, you, I, and all Montanans, who are proud of their state, should be thanking the Department of Fish and Game for offering such an informative and picturesque magazine as MONTANA OUTDOORS.

I contend that the quality of paper used does not have any significance to the overall quality of MONTANA OUTDOORS, whatsoever. In fact, I would be content to read MO on toilet paper bound with a paper clip rather than have the publication cease.

Dale J. Kardash
Freshman, MSU
Bozeman, MT

recycled paper

GROW YOUR OWN HERBS

by Kay Morton

Parsley, chives and mint grow well indoors. Besides adding color to a sunny corner, they give everyday food a flavor lift. (F&G photo by Tom Warren)

WHAT REQUIRES LITTLE care, not much space and grows indoors or outdoors? What adds flavor to the lowliest dish and vitamins to your daily diet? The answer is herbs, the most widely grown of all food plants.

Think of the thousands of window sills with a pot of parsley and the many garden plots with a bed of mint or houses with a clump of chives growing outside the back door. For thousands of years, herbs have been tremendously important, not only to gourmet cooks, but to the hunter in Montana making a venison stew and to the grandmother in Connecticut having her daily cup of linden tea and filling her closets with sachet bags of lavender and lemon verbena.

Record of herb usage goes as far back as 3,000 B.C. when something similar to chives were used by the ancient Chinese. Helen of Troy gathered herbs as Paris carried her away and in 812 A.D., Charlemagne ordered a list of 75 herbs to be planted on his grounds.

herb folklore

A whole body of folklore has grown from medicinal use of herbs. As protection from plague, medieval man hung a bag of garlic around his neck and sometimes even rubbed his body with garlic. Obviously, nobody came very close and he remained healthy. Dill was called 'Meeting House' seed because it was nibbled during church to lessen the "pain" of listening to long sermons. (The word "dill" comes from the Norse *dilla*, meaning "to lull.")

In ancient Greece, rosemary was thought to strengthen the brain and memory. It is still worn by some brides in Europe on their wedding days. An old saying often is presented to the bride along with the rosemary: "There's rosemary for you, that's for remembrance: I pray you, love, remember."

Sweet basil, too, has other than culinary "power." Since it was supposed to chase away bad luck and attract buyers, merchants in Haiti sprinkled their stores with it. An ancient European legend says chewing the root of catnip will make the most gentle person fierce.

Herbs were also used for minor household ills and as beauty preparations. Rosemary rinse was thought to preserve color and curl in brown or black hair. Parsley rubbed on the head for three or four months discouraged baldness. Parsley—a most versatile herb—was also chewed to remove odors of garlic and onions from the breath. Fennel eaten daily made one slim; anise seed warmed in milk promoted sleep. Lavender flowers were sniffed to lift the spirits and rosemary tea cleared the head when suffering from a cold.

Herb teas or *tisanes* do everything from soothing the nerves before bedtime (linden tea) to calming a stomach upset by eating green fruit (ginger tea). The list of herbs from which tisanes can be made is staggering: Joseph E. Meyer's *The Herbalist* lists 87. To make a basic herb tea, add one teaspoon whole or crushed leaves per person, with one extra teaspoon of leaves thrown in "for the pot." Add boiling water and brew for three minutes. Stir, and brew for another minute. Adjust the amount of leaves added per cup to your own taste. Sweeten with honey; many herb teas are also enhanced by serving with a slice of fresh lemon.

herbal scents

Herbs are also useful because of their delightful scents. Some homemakers fill small circles of organdy with lavender or lemon verbena and place them in closets or drawers. Pomander balls for closets are made by sticking whole cloves into oranges or other citrus fruits and adding other herbs and a fixative. Rosemary, mint, sweet marjoram or any other fragrant leaves can be dried, steeped in boiling water and strained into the bath water.

a light touch

Use of herbs in food is certainly nothing new. Many cooks probably don't use herbs simply because they are unfamiliar with them. Subtlety in flavoring and aroma is the secret to the art of herb cookery. Be careful to prevent the herb becoming so strong it takes over the original flavor of the dish. There is nothing worse than the Thanksgiving dressing which tastes only of sage. The amount of herb should give a simple perked-up taste to the natural food.

Use of herbs probably began in warm countries where temperatures on a summer day might reach 100°. Freshly killed game spoiled within a few hours and cooked meats didn't last much longer than 12

Special thanks to State Nursey Co., Helena, for providing the plants in the above photo.

GROW YOUR OWN HERBS continued

hours. However, if the meat was cooked with certain spices, it would keep for days. Cumin, caraway or fennel seeds, cinnamon, nutmeg, cloves, turmeric and everyday pepper retard the spoiling process, keeping the meat or game fresh much longer.

In addition, herbs are excellent sources of vitamins and minerals. Rose hips—the ripe fruits from wild roses—are a superior natural source of Vitamin C and each contains about 10 mg. Indians and early day settlers used herbs which grew around them: watercress is an excellent source of iron, vitamins A, C, D and E and niacin, one of the B-complex vitamins. Dandelion leaves — which were eaten raw or as a cooked green resembling spinach—yield vitamins A, C and calcium. Leaves from sweet clover contain sodium and marigold flowers, potassium. It is doubtful that the whys of such nutrition were understood; a remedy worked, so it was used.

In recent years, interest in culinary herbs has grown. It's more than just a preoccupation with the past or a nostalgic wish to return to Grandmother's beautifully scented kitchen. Industrial preprocessing and prepackaging causes loss of natural color, quality and flavor. Important vitamins and minerals are lost and food is an assembly-line product. Herbs help restore some of the nutritional value and add more flavor—inexpensively—to a daily menu.

growing herbs is easy

Herbs you grow yourself are superior to the grocery store's bottled or packaged varieties. Besides, just think how handy it will be to snip a bit of chives from your own plant and add it to scrambled eggs.

First, figure out how much space you have. If you have lots of room and usually have a vegetable garden, plant a few herbs between the vegetables. If you have limited space, select one or two herbs you think you'll use regularly. If you have no outdoor space, try a pot or two of some of the herbs that grow well indoors; or, plant a bush (perhaps lemon verbena) in a large tub and leave it on a terrace in the summer and bring it indoors for a ready-made winter house plant. Even if you

PREFERRED HERBS

ANISE —sow seeds 1/8 inch deep, germination 28 days, thin to 1 foot apart, maturation 75 days. Needs lots of sun. Harvest when seeds are dull brown. Spread on window screens, leave in a dry and sunny room for several days. As with all dried herbs store in labeled glass jars, with tight-fitting lids, away from direct light. Grows indoors. Uses: licorice-like flavor "spruces up" fruit salads, soups, stews; also used in bread and cookies.

SWEET BASIL —sow seeds 1/4 inch deep in warm earth (about mid-May in Montana); germination 4-5 days. Needs sun. Flowers quickly, resulting in decrease of leaf crop; cut back 3-4 inches from the top as flower buds appear. Leaves usable when plants first come into bloom. Before first frost, wash off with garden hose, cut plants off at root level and tie stems together in loose bunches. Place in paper grocery sacks and dry for two weeks. Separate stems from leaves by rolling between palms; spread dried leaves on a cookie sheet and finish drying in a cool oven (not over 100°). Store as usual. Grows indoors. Uses: powerful and pungent, excellent with rabbit or other game stews; in small quantities with tomatoes, mushrooms and in egg, fish and cheese dishes.

CHERVIL —sow 1/8 inch deep, germination 14 days, thin to 6 inches, maturation in 6-8 weeks. Needs partial shade, can't tolerate heat. Pick leaves from outside so plant keeps growing from center. Plant between other tall herbs or vegetables to assure partial shade. Difficult to dry in oven because it loses its delicate flavor and dries to almost nothing. Place on window screens in airy room in thin layers. When dry, store in air-tight jars in the dark to preserve as much flavor as possible. Will grow indoors, but don't transplant from outdoors to indoors, or vice versa. Uses: parsley-like leaves used (fresh or dried) in salads, French dressing, cream cheese or with peas, tomatoes or spinach; in soups, meat stews and omelettes.

CHIVES —buy clumps from nursery; plant outdoors after last spring freeze. Clumps may be divided into 3-6 bulblets and transplanted. Cut back the foliage after transplanting. Cover with leaves in Montana winter. To use, cut spears from side and cut to base of clump. To preserve, harvest in early morning and mince. Seal in plastic wrap (in amounts suitable for a single recipe) and freeze. Grows indoors; use at least a five-inch container. Needs a sunny window with cool temperatures (55-60°). Uses: mild onion flavor appealing in cottage cheese, cream cheese, egg dishes.

DILL —sow 1/4 inch deep, germination 7 days, thin to 8-12 inches; leaves mature in 75 days, seed in about 100. Hardy; may be planted as early as April in Montana. Will self-sow second season, if allowed to go to seed. To harvest, dry heads and shake in a sack to release *seeds*. To dry *leaves*, place in cool oven with door open and dry until crisp to the touch. Uses: pungent, slightly bitter seed in pickles, sauces, salads and sauerkraut; more delicately flavored leaves with vegetables and fish.

LEMON VERBENA - propagated by cuttings (at least 3 inches long) from a growing tip; include 2 nodes (where leaves attach to branch). Root in a glass of water or very moist sand or cinders. Keep in shade and away from drafts. Transplant rooted cutting to big tub; keep on terrace or patio in summer, indoors in winter. Local nurseries may not stock; try distributors listed above. Uses: tea, flavoring in fruit drinks, jams, jellies. A few leaves left in the sugar cannister provide a delightful citrus hint to cakes or cookies.

SWEET MARJORAM —sow 1/8 inch deep; small seeds, so mix with sand before scattering; germination 10 days. Young plants tender, so start indoors and transplant 8-10 inches apart outside after last spring freeze; maturation 70 days. Harvest when knotty flower growing from top of stem looks as if it's about to burst. Cut 2 inches above ground level. Wash, drain, spread on screen frame to dry (not in direct sun). Turn clippings daily. When they feel very dry to the touch, place in thin layers in cool oven. Roll leaves from stems. Uses: distinctive sausage flavoring; also with poultry dressing, meats,

have a tiny apartment with little light and no outdoor space, don't give up: you can always gather your own rose hips, dandelions, watercress or wild onions.

Generally, herbs demand little from the soil. You need only prepare the soil as you would if you were planting a garden. Do keep in mind specific requirements of the herbs you select.

A few hints apply to most herbs. When storing them, try to obtain brown-tinted glass jars; the brown keeps out more light. Always use tight-fitting lids and label each jar. If, after drying, moisture condenses on the jar, the herb has not been sufficiently dried and it will mold. Dry for another hour in a cool oven.

Seeds for many of the herbs discussed below are easier to find than you might think. At a Helena supermarket, seed packets for dill, catnip, sweet basil, coriander, dill, thyme, sweet marjoram, summer savory, rosemary, oregano, sweet fennel and lavender were found. Local nurseries regularly stock parsley, chive and mint plants. However if you have difficulty finding a specific herb, try writing one of the following (list taken from Angelo M. Pellegrini's *The Food-Lover's Garden*):

Earl May Nursery
Shenandoah, IA 51601

Henry Field Co.
Shenandoah, IA 51601

Tool Shed Herb Nursery
Salem Center
North Salem, NY 10560

Wayside Gardens
Mentor, OH 44060

Weston Nurseries
East Main Street
Hopkinton, MA 01748

White Flower Farm
Litchfield, CT 06759

For shallots:
GNL Shallot Dist.
51 De Shibe Terrace
Vineland, NJ 08360

Les Eschalotes
Ramsey, NJ 07446

It doesn't matter if you're bald, have a stomach ache from eating green fruit or simply want to do something different with a tossed salad, herbs have something to give. Try them—you'll be surprised at the versatility of these spice plants.

stews. Rubbed into duck, goose, rabbit, hare, venison, veal or pork before roasting. Enhances fish and green salad.

MINT—Buy a plant at a nursery or take a stem from a friend's plant. Stem should be at least 3 inches long and have 3 (or more) well developed shoots. Shoots will eventually bend toward the ground, take root at the tip and produce new plants. Place cutting in water several hours before planting; plant in early spring in small holes, 2 inches deep and 1 foot apart. Water the holes before planting if soil seems dry. Mint needs shelter, with some shade. Takes much goodness from soil, so add compost or bone meal. Grows by runners; tends to "take over" so contain runners by imbedding metal slats in ground. Grows well indoors; use small container so roots will be restricted. To harvest, cut off tops while flowers are still in bud. Strip leaves from stems. Dry on frames in cool oven. For tea, leaves should be whole. To pulverize, strip off leaves, dry and rub them between palms. Store in air-tight containers in the dark. Uses: refreshing spearmint flavor as a tea; in mint sauce (traditional with lamb), in juleps, split pea soup, wild meat marinades, with carrots or peas, and as a garnish.

OREGANO—called wild marjoram in some parts of the U.S. Start from seed or by rooting a cutting. Seeds are small; sprinkle on top of the soil and press *lightly* in. Germination 14 days, thin to 12 inches, maturation 45 days. Needs sun, and dry, warm and gravelly soil. Harvest when flower heads form (plants will be about 2 feet high). Wash off, hang to dry, enclose in paper bag and proceed as with sweet basil. Grows indoors. Uses: the distinctive flavoring in pizza, spaghetti sauce and other Italian dishes; especially good if elk or other wild meat is used as a spaghetti sauce base.

PARSLEY—Start indoors about 8 weeks before planting. Soak seeds; sow 1/4 inch deep; takes a long time to germinate; transplant when danger of frost is past, 6 inches apart, in partial shade. To pick, select outer sprigs. To transplant from garden to indoors, dig under the plant so a good ball of earth comes up. Place in a deep pot (parsley has a taproot) in a cool, sunny window. Wash leaves occasionally under tap to prevent insect damage which can occur indoors. Harvest in young, leafy stage. Chop, place in small bags and freeze or dry on a wire screen in a 400° oven for 5 minutes, watching carefully, and turning once. Rub leaves through a coarse sieve. Uses: well known green color and flavor goes with egg dishes, potatoes, soups, sauces, salads, poultry dressing, salad dressing and as a garnish.

ROSEMARY — sow seeds 1/4 inch deep; germination 12 days, transplant 3 feet apart. Probably won't survive Montana winter, so plant in tub or large pots which can be brought indoors. Keep in cool, light place. Spray tips with water when the plants are indoors to prevent drying. Bushes will not be ready for harvest by end of first summer; harvest in about August of second summer. Place stems and leaves in sack and dry for several weeks; strip leaves (resembling pine needles) from stems, which should be brittle. Uses: flavors roasting chicken; make slits in roast of pork and insert leaves; sprinkle inside and outside of venison, duck, pheasant or quail lightly before roasting. Use in stuffings for rabbit, partridge; complements eggplant and is the staple herb in Greek cookery.

SHALLOTS—order bulbs from reputable seed catalog or distributor. Plant at least 8 inches apart, in dry soil, in early May. Harvest in early September or when tops wither and begin to turn brown. Grows in clumps; braid tops together and hang to dry or divide clumps and allow to dry outdoors in sun for 4-5 days. Store in shallow boxes in a dry, well ventilated room. Uses: stronger than chives but more subtle than garlic, imparts its flavor to omelettes, sauces; used in many French recipes. With sage hens: soak hens (refrigerated) for at least 24 hours in a salty brine. Rinse thoroughly and soak for a couple of hours in cold, clear water. Melt 1/3 cup butter (not margarine) in a large frying pan; add meat, after dredging it in flour, salt and pepper. Add about 4 shallots, minced, and mix them in with the butter and browning meat. After browning meat thoroughly on both sides, add about 1 cup of sherry (use dry or cocktail sherry, but not cooking sherry). Continue simmering, covered, until meat is done, about 75 minutes.

story and photos
by Ray Mapston

ANTELOPE

To escape danger, Nature provides the fawn with a protective cover of sagebrush and a natural instinct to remain absolutely motionless.

FAWNING TIME

. . .a time of possible danger, but fortunately, Nature has provided.

WITH CHARACTERISTIC WISDOM, nature has seen to it that many wild animals are born during late spring, normally a time of warmth and abundance. So it is with the pronghorn antelope on most of its range.

Antelope fawning time in the northern states begins in late May and extends until late June. This contrasts with southern antelope ranges—such as southern Texas—where fawns may be born as early as April. In Hawaii, where antelope were introduced some years ago, fawns are born throughout the year.

As the fawning season approaches, expectant mothers separate from the main herd and look for a suitable fawning area. Rolling areas with a low growth of sagebrush are preferred. Groups of pregnant does commonly gather on the same fawning ground several weeks before actual fawning begins; here they linger, awaiting arrival of their babies. They will remain for several weeks after the fawns are born.

giving birth

The doe prefers to go off by herself to give birth, and this is a sure sign that delivery is imminent. While some fawns are dropped wherever the doe happens to be when her time arrives, others seem to select specific birth sites and remain there until the babies are born. Favorite locations are small secluded basins, covered with moderate stands of sagebrush from nine to fifteen inches high, and surrounded by low hills.

At a time determined by mating eight months before, the fawns are born. In first pregnancies, one or two fawns may be born. Thereafter, providing range conditions are favorable, a majority of the does produce twins.

Twins are usually delivered within half an hour of each other and dropped only a few feet apart.

good mothers

The antelope doe lavishes tender care on her babies. Immediately after birth she vigorously licks the wet little fawns from head to toe with her rough tongue. This not only washes and hastens drying of the fawn, but probably enables the mother to distinguish them from others in the area. The doe nuzzles the fawns and goes over every inch of them, as if to make sure each is perfect.

Although weak at first from the shock of entering the world, the unusually well developed fawns are generally stumbling about shortly after birth. They seem obsessed with the need to stand and it is common for them to be on their feet and taking a few shaky steps within an hour. Nursing comes naturally, but the instinct is apparently awakened when the doe crouches over the fawns and puts her udder within reach. After a period of trial and error, the youngsters feed with considerable vigor.

The little fawns appear to be all legs, ears and eyes. Average birth weight is about six pounds. Unlike the young of deer and elk, antelope babies

FAWNING TIME continued

are not spotted. A uniform gray-brown, their color pattern is very faint.

fawns hide

After her babies are cared for and rested, the mother usually leads them some distance from the place of birth. Possibly the doe wishes to leave the area before an enemy is attracted by any scent which might be present. She leaves the fawns lying down, usually at separate locations, and then moves to a vantage point some distance away to rest and keep watch over the nursery. She will return to nurse the youngsters at three- to four-hour intervals. The first week of a fawn's life is a lonely, inactive one and over 80 per cent of that time is spent hiding.

Concealment is the fawns' only defense during the first few days and they instinctively lie unmoving and curled up against the ground until their mother returns. The doe knows this as well. By staying away from her offspring, except at mealtime, she avoids calling attention to their locations.

Additional protection is provided for young fawns since they apparently have little scent and their coloration blends in with the earth and surrounding vegetation. When lying motionless— typically in a curled-up position with ears laid back against the neck—a fawn looks much like a mound of earth or a rock. The fawns usually lie between several closely spaced sagebrush plants which further conceals them. Therefore, the fawns are difficult to see even if one knows their general locations and is searching for them.

The instinct for escaping detection by lying perfectly still is obviously strong. Patiently awaiting the return of their mothers, the babies don't move for hours. Even when one comes within a few feet or even inches of them, young fawns remain motionless, although aware of the intruder. Sometimes they do not move even when a net is placed over them or they are touched.

nursing

When feeding time arrives, prompted partially by a physiological need to relieve milk pressure, the doe carefully scans the area to make certain no disturbance is near. If there is a potential threat, she will stay away from her fawns, even if they must go hungry for awhile. When all is well, she moves quickly to the area where her fawns are hidden.

When its mother comes near, a fawn over one day old usually jumps up and goes to meet her. (Younger fawns normally do not rise until nuzzled by the doe.) She may nurse one fawn at a time, but does commonly bring both babies together to nurse. If the doe spots possible danger when the fawns are standing up, she will flee and her offspring will drop immediately to the ground and lie still.

Feeding time is an enthusiastic event and mother and babies greet each other with delight. The hungry fawns nurse eagerly, their short tails wagging vigorously. This is also a get-acquainted period for the twins, since they remain together only a short time after birth and bed separately for more than a week. The frisky fawns take advantage of this opportunity for lively play.

Each nursing session lasts less than 30 minutes and consists of several short feedings, usually from 30 to 60 seconds. Although the antelope doe gives a limited amount of milk per feeding (eight ounces or less), its nutritional content is very high.

mortality factors

Bobcats, coyotes and golden eagles kill some fawns, but predators are not as destructive as some reports indicate. Loss to predators decreases after the fawns are a few weeks old.

Instinctively protective, the doe is alert to any intrusion that might affect her young. Usually her vigilance and exceptional eyesight enable her to spot an intruder before it can get close to a fawn's hiding place. If a coyote or bobcat is in the general vicinity, she ordinarily pretends indifference and unconcern. If an enemy tries to get her young, she will attack without hesitation. Accounts have been reported of a doe chasing away a coyote which threatened her offspring. Antelope mothers sometimes attempt to lure predators away from fawns by offering themselves as decoys.

Young fawns make a highpitched, quivering bleat audible at a substantial distance. This is used effectively to summon the mother when needed. With maternal instincts and anger aroused, does will occasionally charge a man.

One of the remarkable things about antelope fawns is their rapid development. They have surprising agility two days after birth and by the third day are capable of outrunning a man, for short distances. Within a week, the youngsters run with a synchronized gait and have considerable endurance. More important, the fawns have acquired the instinct for detecting danger and they will readily use their speed to escape enemies. This was apparent during projejcts to place plastic streamers in fawns' ears to trace movements. When

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ABOUT THE AUTHOR

Raymond D. Mapston is a wildlife biologist for the Casper (Wyoming) District, Bureau of Land Management. He specializes in antelope habitat studies. He holds a B.S. in wildlife management and a M.S. in range management, both from the the University of Arizona, Tucson. This article is based on personal observations while Mapston studied and photographed antelope fawning activities during the past seven years.

One week after birth, antelope fawns can run with considerable speed and endurance. In a month or so, they develop the speed for which their species—the fastest North American land mammal—is noted.

a week old, fawns were nearly impossible to capture.

sociability

As the fawns grow stronger, they spend more and more time with their mothers. Since antelope are herd-oriented and enjoy company of their own kind, the family soon joins a small band of five to ten does and their young. The band behaves much like a "big, happy family."

In the coming months the fawns become part of an antelope community and learn many things vital to their welfare. Although capable of racing to their mother's side when endangered, fawns still have the tendency to drop tc the ground and lie motionless when an enemy is spotted. Often a fawn will flee for a short distance and, at the first opportunity, hide in the sagebrush. A fawn does not appear to slow down when it decides to hide; while running at full speed, it suddenly drops to the ground and out of sight.

A good example of the antelope's sociability is the practice of "baby-sitting," an established custom in antelope society. It is common for a doe to care for as many as 12 fawns while other mothers feed or go to water a considerable distance away. The fawns do not seem bothered by their mothers' absence, even though the mothers may be gone several hours. How the "baby-sitter" is selected and whether this responsibility is rotated is not clear.

fawns playful

Fawns, like most young things, have a strong inclination to play; they are rambunctious and seem to have an inexhaustible energy supply. Their lively antics are enjoyable to watch.

As if aware they are the swiftest of North American mammals, fawns take great pride in their running ability. Lone fawns race here and there just for the joy of running. When the fawns are in groups, a race or some type of play inevitably develops. They often engage in group races at breakneck speed in which several run in great arcs, dodging between sagebrush plants. Romping sessions resemble games of tag or follow-the-leader. Besides running, chasing and jumping, the fun-loving fawns also spar and butt just like the adults.

Throughout the summer, the fawns grow rapidly. At three months, they have acquired adult coats and more than half their growth. The fawns remain with their mothers until the next fawning season. At this time, knowing that last year's offspring can take care of themselves, the doe runs them off and prepares for the birth of her new babies.

EDITOR'S NOTE—In Montana, antelope depend heavily on the sagebrush-grassland vegetative type. As noted in this article, sagebrush provides fawns with protective cover. After fawns mature, they continue to benefit, and in fact, depend on sagebrush. Several studies indicate that it accounts for the bulk of the antelope's winter diet. With this in mind, it's easy to understand this department's concern over sagebrush control programs—past and present—of public agencies such as the Bureau of Land Management and the U.S. Forest Service.